United States Department of Agriculture

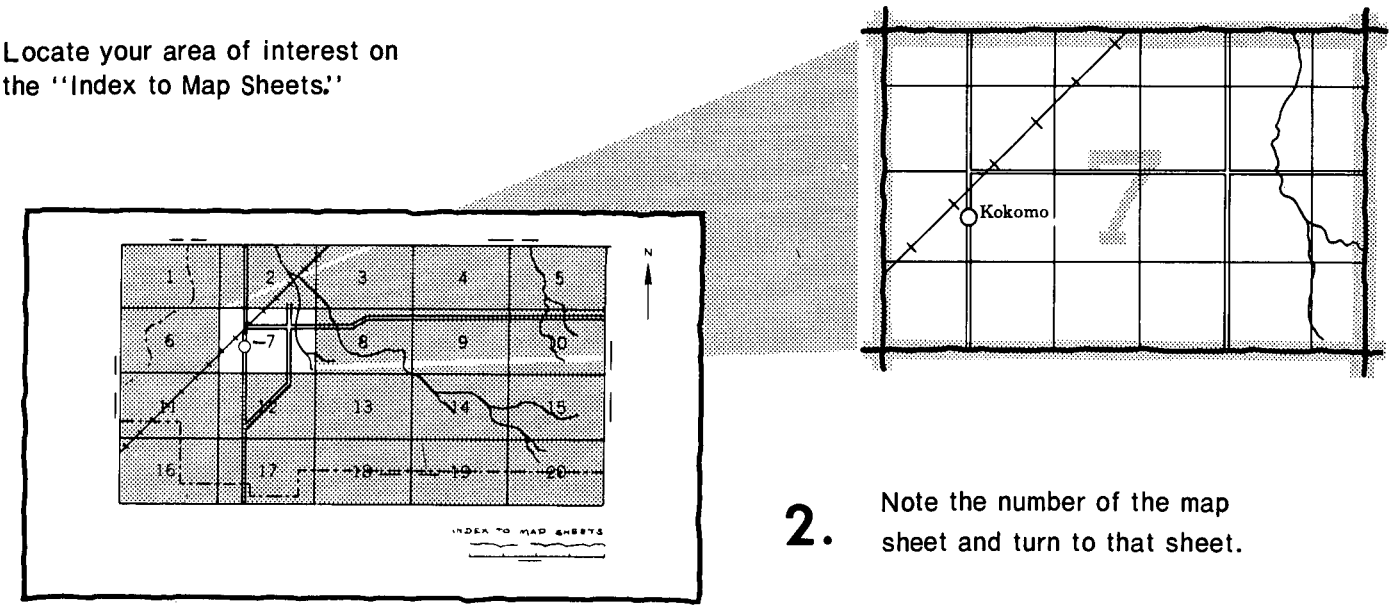
Soil Conservation Service

In cooperation with Kentucky Natural Resources and Environmental Protection Cabinet and Kentucky Agricultural Experiment Station

Soil Survey of Ohio County, Kentucky

HOW TO USE

1. Locate your area of interest on the "Index to Map Sheets."



2. Note the number of the map sheet and turn to that sheet.

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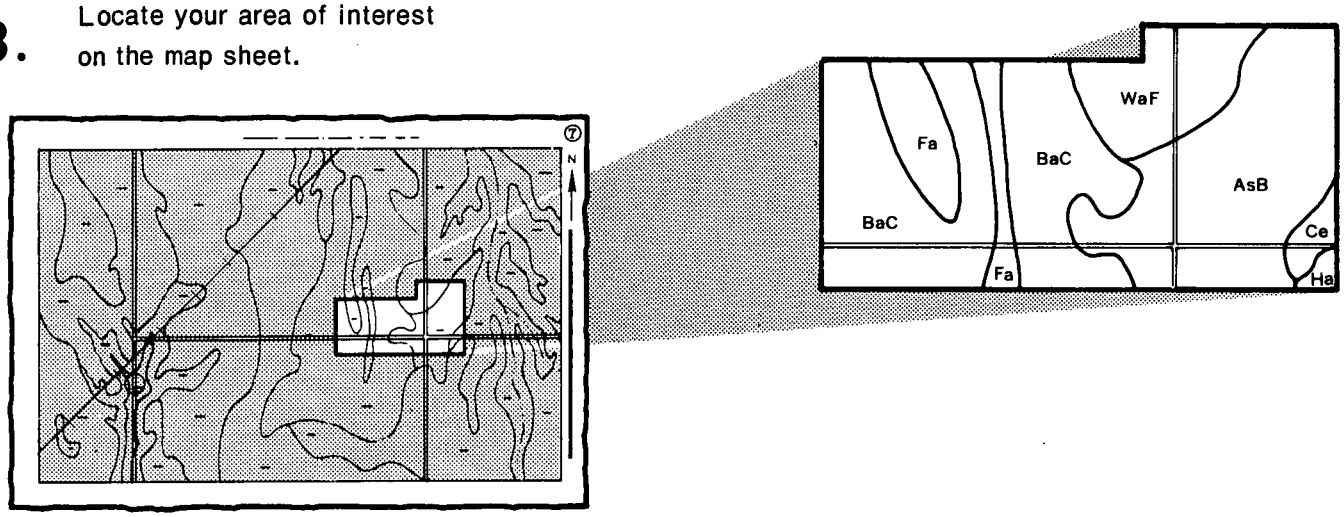

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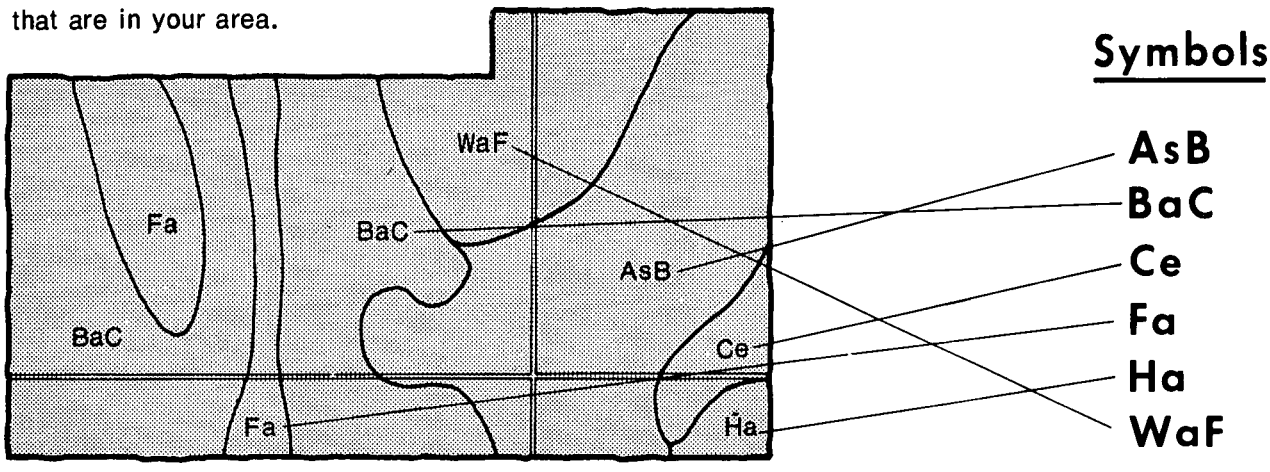

THIS SOIL SURVEY

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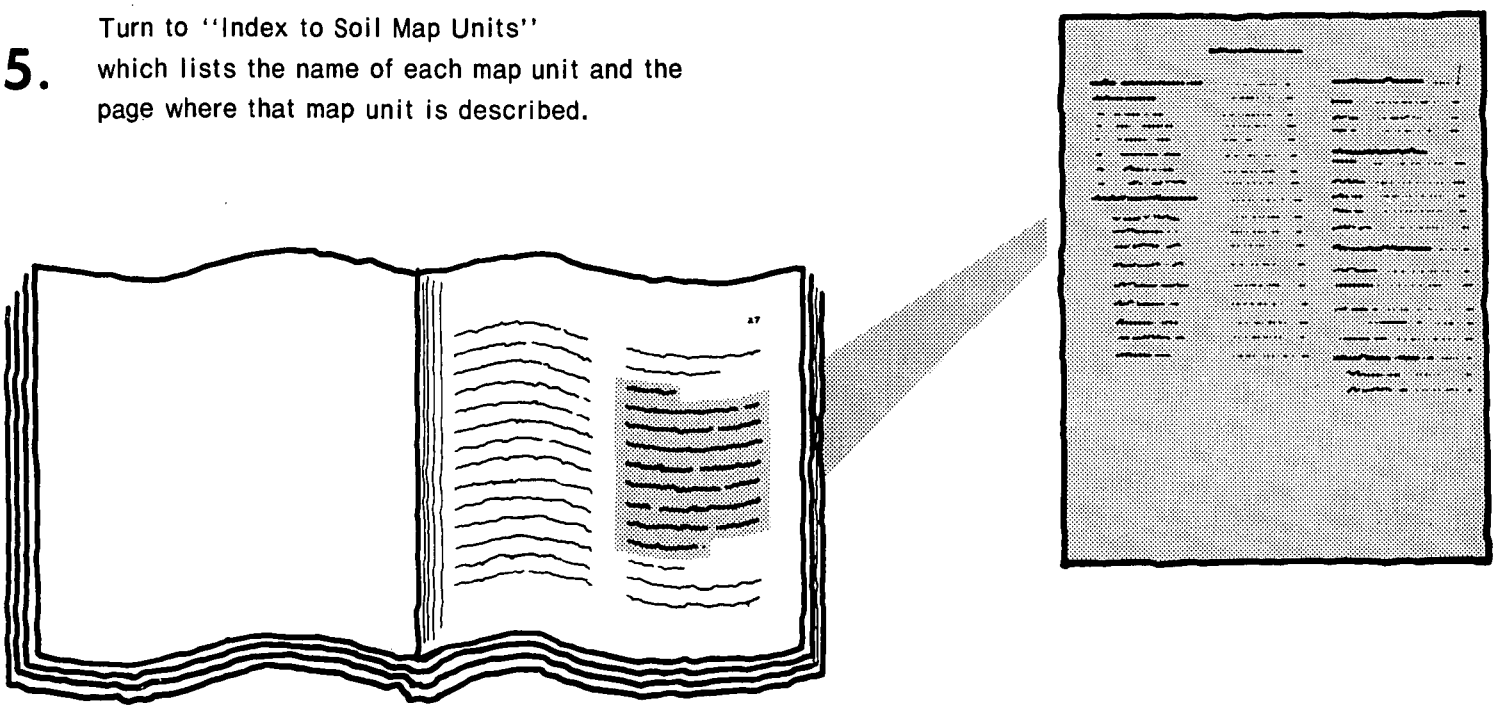
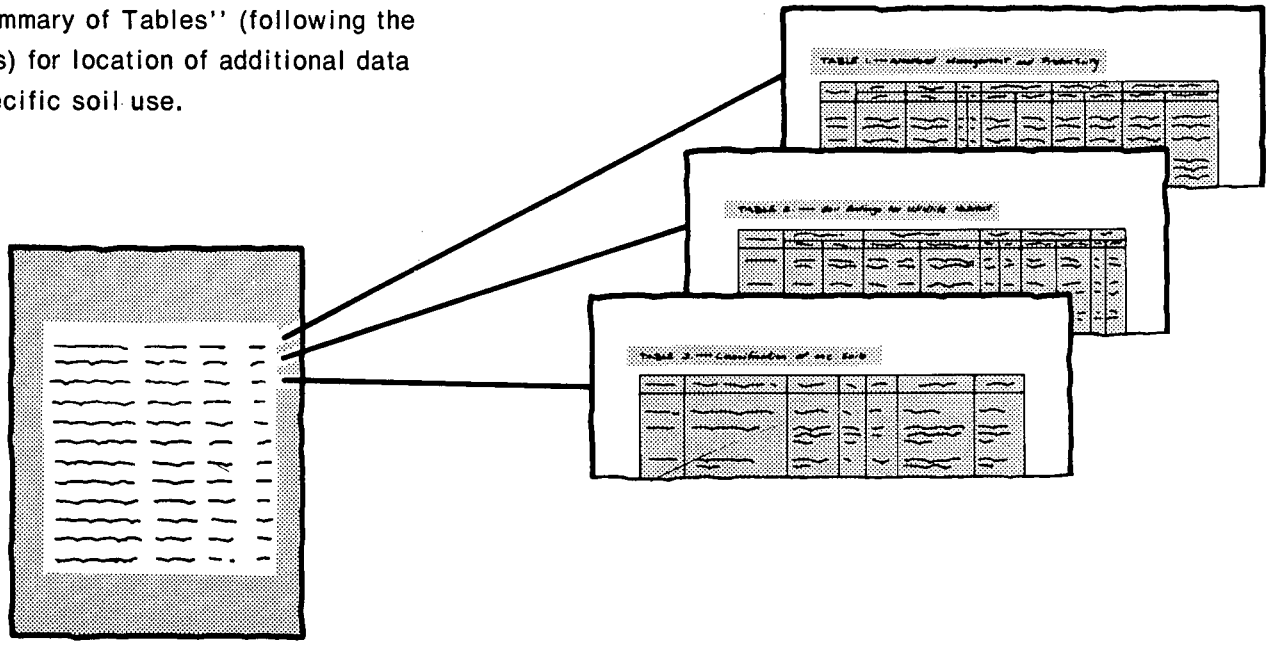


6. See "Summary of Tables" (following the Contents) for location of additional data on a specific soil use.



7. Consult "Contents" for parts of the publication that will meet your specific needs. This survey contains useful information for farmers or ranchers, foresters or agronomists; for planners, community decision makers, engineers, developers, builders, or homebuyers; for conservationists, recreationists, teachers, or students; to specialists in wildlife management, waste disposal, or pollution control.

This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other federal agencies, state agencies including the Agricultural Experiment Stations, and local agencies. The Soil Conservation Service has leadership for the federal part of the National Cooperative Soil Survey. In line with Department of Agriculture policies, benefits of this program are available to all, regardless of race, color, national origin, sex, religion, marital status, or age.

Major fieldwork for this soil survey was completed in 1982. Soil names and descriptions were approved in 1983. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1983. This soil survey was made cooperatively by the Soil Conservation Service, the Kentucky Natural Resources and Environmental Protection Cabinet, and the Kentucky Agricultural Experiment Station. It is part of the technical assistance furnished to the Ohio County Conservation District.

Soil maps in this survey may be copied without permission. Enlargement of these maps, however, could cause misunderstanding of the detail of mapping. If enlarged, maps do not show the small areas of contrasting soils that could have been shown at a larger scale.

Cover: Home and pasture on Frondorf-Wellston-Rosine silt loams, 12 to 20 percent slopes, eroded.

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Foreword

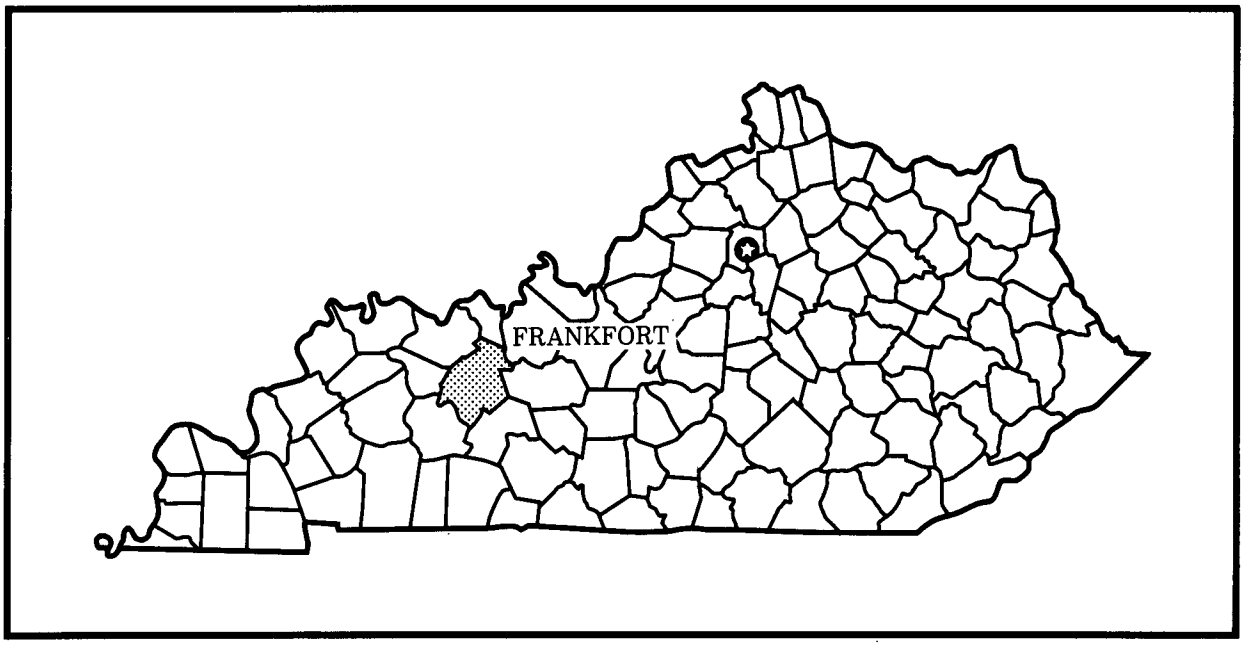
This soil survey contains information that can be used in land-planning programs in Ohio County. It contains predictions of soil behavior for selected land uses. The survey also highlights limitations and hazards inherent in the soil, improvements needed to overcome the limitations, and the impact of selected land uses on the environment.

This soil survey is designed for many different users. Farmers, foresters, and agronomists can use it to evaluate the potential of the soil and the management needed for maximum food and fiber production. Planners, community officials, engineers, developers, builders, and home buyers can use the survey to plan land use, select sites for construction, and identify special practices needed to insure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the survey to help them understand, protect, and enhance the environment.

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are shallow to bedrock. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

These and many other soil properties that affect land use are described in this soil survey. Broad areas of soils are shown on the general soil map. The location of each soil is shown on the detailed soil maps. Each soil in the survey area is described. Information on specific uses is given for each soil. Help in using this publication and additional information are available at the local office of the Soil Conservation Service or the Cooperative Extension Service.

Randall W. Giessler
State Conservationist
Soil Conservation Service



Location of Ohio County in Kentucky.

Soil Survey of Ohio County, Kentucky

by Frank R. Cox, Jr., Soil Conservation Service

Fieldwork by Frank R. Cox, Jr. and James E. Haagen,
Soil Conservation Service, and Steve E. Jacobs and Steve R. Hurst,
Kentucky Natural Resources and Environmental Protection Cabinet

United States Department of Agriculture, Soil Conservation Service
In cooperation with the
Kentucky Natural Resources and Environmental Protection Cabinet
and the Kentucky Agricultural Experiment Station

OHIO COUNTY is in the Western Coal Field region of Kentucky *(14)*. It has an area of 381,574 acres. Hartford is the county seat. Other incorporated towns are Beaver Dam, Centertown, Fordsville, McHenry, and Rockport. The population of the county in 1980 was 21,756.

The topography of the county ranges from nearly level to hilly. The nearly level areas are on the flood plain of the Green River and its tributaries. Most of the soils on the flood plain have a seasonal high water table and are drained before they are used. The soils on uplands range from gently sloping to steep, and erosion control measures are needed for most uses. Generally the nearly level soils are used for the production of cultivated crops, and the steep soils are forested. Other soils, which are intermediate in slope, are cultivated, pastured, or forested.

The economy of the county is based mostly on the mining of coal and farming. Several large mines in the county are mining coal; and large areas, mostly in the southwestern part of the county, have been strip-mined. Some small industries process wood products and manufacture furniture, lamps, clothing, brass products, and plastic coated products. The production of oil also adds to the economy of the area.

Ohio County has many potential sites for industry. The upland soils are above flood level, and sites on other soils can be protected from flooding by the use of dikes and levees. Transportation is available to bring in raw materials and ship out manufactured products. Ohio County is within shipping distance of many industrial centers. Also energy is available in the county in the form of coal and oil. The potential for wildlife habitat and recreational areas is extensive, and these are the best uses for some steep soils.

General Nature of the Survey Area

This section provides general information about Ohio County. It briefly describes history and development, climate, geology, relief and drainage, natural resources, transportation and markets, and farming.

History and Development

Ohio County was formed in 1798 from Hardin County and included what is now Daviess County and parts of McLean, Henderson, Hancock, Breckinridge, Grayson, and Butler Counties *(11)*. It was named for the Ohio River, which was the northern boundary at that time.

The first permanent settlement in Ohio County was before 1785 at either Hartford or Barnett's Station, which was about 2 miles northeast of Hartford. Hartford was established as the county seat in 1799 at the first meeting of the county court.

The early settlers in Ohio County came mostly from Virginia, Maryland, North Carolina, and parts of Kentucky east of Ohio County. Many were of Scotch-Irish descent. They were primarily farmers who cleared land, built cabins, and established farms. The main crops were corn, tobacco, wheat, and grasses and legumes for hay and pasture. Livestock were mostly cattle, hogs,

chickens, horses, and mules. Some of the crops and livestock were consumed at home. The surplus was sold to markets outside the area. Transportation to world markets was by barge down the Rough River, the Green River, the Ohio River, and the Mississippi River. Railroads were built into the county during the latter part of the nineteenth century and provided transportation to outside markets.

When the first settlers came, Ohio County was covered with hardwood forests. The trees were oak, hickory, elm, ash, maple, beech, gum, cottonwood, yellow-poplar, and black walnut. A few low areas probably had a cover of mostly cane, sedges, and water grasses. The early settlements were on uplands where the soils were better drained. Many lowlands were not cleared of timber until the latter part of the nineteenth century or early in the twentieth century. Some of the uplands are no longer being used for farming, and they are reverting to hardwood forests through natural revegetation processes.

Climate

Prepared by the National Climatic Center, Asheville, North Carolina.

In Ohio County, summers are hot in the valleys and slightly cooler in the hills; winters are moderately cold. Rains are fairly heavy and well distributed throughout the year. Snow falls nearly every winter, but the snow cover usually lasts only a few days.

Table 1 gives data on temperature and precipitation for the survey area as recorded at Beaver Dam in the period 1951 to 1980. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on length of the growing season.

In winter the average temperature is 37 degrees F, and the average daily minimum temperature is 27 degrees. The lowest temperature on record, which occurred at Beaver Dam on January 24, 1963, is -25 degrees. In summer the average temperature is 76 degrees, and the average daily maximum temperature is 88 degrees. The highest recorded temperature, which occurred at Beaver Dam on July 26, 1952, is 106 degrees.

Growing degree days are shown in table 1. They are equivalent to "heat units." During the month, growing degree days accumulate by the amount that the average temperature each day exceeds a base temperature (50 degrees F). The normal monthly accumulation is used to schedule single or successive plantings of a crop between the last freeze in spring and the first freeze in fall.

The total annual precipitation is 46 inches. Of this, 23 inches, or 50 percent, usually falls in April through September. The growing season for most crops falls within this period. In 2 years out of 10, the rainfall in April through September is less than 18 inches. The heaviest 1-day rainfall during the period of record was 4.63 inches at Beaver Dam on March 4, 1964. Thunderstorms occur on about 45 days each year, and most occur in summer.

The average seasonal snowfall is 5 inches. The greatest snow depth at any one time during the period of record was 15 inches. On an average of 7 days, at least 1 inch of snow is on the ground. The number of such days varies greatly from year to year.

The average relative humidity in midafternoon is about 60 percent. Humidity is higher at night, and the average at dawn is about 80 percent. The sun shines 65 percent of the time possible in summer and 45 percent in winter. The prevailing wind is from the south. Average windspeed is highest, 10 miles per hour, in spring.

Geology

Ohio County is in the Western Coal Field physiographic region *(4, 14)*. The county is underlain by bedrock of the Pennsylvanian age and the Mississippian age *(10)*. Over the bedrock is a thin mantle of loess that ranges from a few inches on steep slopes to 6 feet thick in a few places in the northwestern part of the county. Thickness of the alluvium in the valleys ranges from 6 to 50 feet, or more.

Most of the surface bedrock is of Pennsylvanian age. In the southwestern part of the county the bedrock is in the Lisman Formation of Upper Pennsylvanian age. In other parts of the county the bedrock is in the Carbondale, Tradewater, and Caseyville Formations of the Middle and Lower Pennsylvanian age. The bedrock is mostly sandstone, siltstone, and shale, but it includes important beds of coal.

Bedrock of Mississippian age outcrops mainly in the Rough Creek Fault System that extends east and west through the central part of the county. It is also exposed in the upper reaches of the Rough River Valley. The Upper Mississippian bedrock is sandstone, siltstone, shale, and limestone. North of the Rough Creek Fault System the rocks dip to the west; south of the fault system and in the system itself the rocks dip to the south and southwest.

Relief and Drainage

The relief of Ohio County ranges from nearly level to steep. The soils on uplands have slopes that range from gently sloping to steep, and the soils on flood plains are nearly level.

Most of the soils in Ohio County are on uplands. A common pattern in the uplands is gently sloping soils on narrow hilltops and moderately steep and steep soils on side slopes. Most flood plains are in narrow valleys. The widest valley in the county is along the Rough River west of Hartford; it is 2 to 3 miles wide.

The Green River and its tributaries carry the runoff from the county. The Green River flows to the northwest along the southwestern boundary of the county. The

Rough River, a tributary of the Green River, flows to the west across the central part of the county to its confluence with the Green River at the western boundary of the county. About 60 percent of the county drains into the Rough River. About 10 percent of the county in the northwestern part drains into Panther Creek, which flows into the Green River through Daviess County. The rest of the county drains into the Green River through small tributaries.

Natural Resources

Coal, oil, natural gas, trees, limestone, sandstone, fire clay, and water are among the natural resources of Ohio County.

Coal is the most important revenue-producing natural resource in the county. Coal is mined from both strip mines and underground mines. The trend in recent years is toward more strip mines and the use of big equipment.

Oil fields and natural gas fields are in several parts of the county. Oil fields outnumber gas fields, and revenue from oil production is greater than revenue from gas production. Most gas has been produced from oil wells as a byproduct of oil production, and commercial production of gas has been small.

The native vegetation of the area is hardwood trees. They are on wet soils and on sloping to steep uplands. Sawmills make bridge planks and barn patterns from the best logs and make chips for wood pulp from other logs. Mine props, furniture, and pallets are also made from native wood.

Limestone bedrock is near the surface in a few places in the county. Quarries supply limestone to surface roads, for industrial use, and for agricultural limestone. Sandstone bedrock is near the surface in most of the county. The early settlers used sandstone for chimneys and foundations of buildings, but modern builders use other construction materials.

Fire clay is mined in adjoining Hancock County, and Ohio County probably has commercial quantities of it. Fire clay generally is beneath layers of coal. It is used in nearby areas to make sewer pipe, brick, and ceramic tile.

The Green River, the largest stream in the area, has sufficient water for navigation, recreation, or industrial use. Locks and dams insure enough depth to make the river navigable at all times. The Rough River also has flowing water all year; most other streams have flowing water only during wet seasons.

Most of the county has limited quantities of underground water. In the past, rural residents obtained water for home use from wells or cisterns; now water is piped to many parts of the area. Ponds provide water for livestock, irrigation, and recreation. Several recreational areas have large lakes and have public facilities for swimming, fishing, and camping.

Transportation and Markets

Transportation for both supplies coming into the county and products going to market is by highway, railroad, and river.

Paved roads are in, or near, all parts of the county. Two federal highways and several state highways cross the county. Also two four-lane toll roads cross the county. Trucks haul farm products, coal, and manufactured products to market and also bring supplies to farmers and local merchants.

One railroad crosses the county, and several rail spurs serve other parts of the county. Coal, grain, lumber products, and manufactured products move to market by rail.

Locks and dams on the Green River insure a channel that is deep enough to be navigable at all times. Coal and grain move to market by barge.

Most markets for farm products are in adjoining counties. Some coal is used locally, but most of it is transported to industrial centers outside the area. Most crude oil is piped to refineries outside the area. Manufactured products are sold both in the county and in urban centers in other areas.

Farming

Farming is important to the economy of the area. Important crops are corn, soybeans, tobacco, small grains, hay, pasture, and trees. Soybeans, tobacco, and small grains are sold as cash crops. Some corn is sold, and some is fed to hogs, which in turn are sold. Most hay and pasture are used for beef cattle, which are sold.

In 1978 there were 1,190 farms in the county, and the average size was 152 acres *(8)*. Many farmers supplement their income by working away from the farm. About two-thirds of the farm operators have a principal occupation other than farming. About three-fourths of the farm operators live on the farm they operate.

The most intensively farmed areas are nearly level or gently sloping soils. These areas are mostly in valleys or on hilltops throughout the county. Most of the county has soils that are suited to intensive cultivation and soils that are suited to hay and pasture. Steep soils that are suited to woods and are not suited to cultivation are scattered throughout the uplands.

How This Survey Was Made

This survey was made to provide information about the soils in the survey area. The information includes a description of the soils and their location and a discussion of the suitability, limitations, and management of the soils for specified uses. Soil scientists observed the steepness, length, and shape of slopes; the general pattern of drainage; the kinds of crops and native plants

growing on the soils; and the kinds of bedrock. They dug many holes to study the soil profile, which is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material from which the soil formed. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

The soils in the survey area occur in an orderly pattern that is related to the geology, the landforms, relief, climate, and the natural vegetation of the area. Each kind of soil is associated with a particular kind of landscape or with a segment of the landscape. By observing the soils in the survey area and relating their position to specific segments of the landscape, a soil scientist develops a concept, or model, of how the soils were formed. Thus, during mapping, this model enables the soil scientist to predict with considerable accuracy the kind of soil at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, acidity, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. The system of taxonomic classification used in the United States is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

While a soil survey is in progress, samples of some of the soils in the area are generally collected for laboratory analyses and for engineering tests. Soil scientists interpreted the data from these analyses and tests as well as the field-observed characteristics and the soil properties in terms of expected behavior of the soils under different uses. Interpretations for all of the soils were field tested through observation of the soils in different uses under different levels of management. Some interpretations are modified to fit local conditions, and new interpretations sometimes are developed to meet local needs. Data were assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management were assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can state with a fairly high degree of probability that a given soil will have a high water table within certain depths in most years, but they cannot assure that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Map Unit Composition

A map unit delineation on a soil map represents an area dominated by one major kind of soil or an area dominated by several kinds of soil. A map unit is identified and named according to the taxonomic classification of the dominant soil or soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural objects. In common with other natural objects, they have a characteristic variability in their properties. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of soils of other taxonomic classes. Consequently, every map unit is made up of the soil or soils for which it is named and some soils that belong to other taxonomic classes. In the detailed soil map units, these latter soils are called inclusions or included soils. In the general soil map units, they are called soils of minor extent.

Most inclusions have properties and behavioral patterns similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting (similar) inclusions. They may or may not be mentioned in the map unit descriptions. Other inclusions, however, have properties and behavior divergent enough to affect use or require different management. These are contrasting (dissimilar) inclusions. They generally occupy small areas and cannot be shown separately on the soil maps

because of the scale used in mapping. The inclusions of contrasting soils are mentioned in the map unit descriptions. A few inclusions may not have been observed, and consequently are not mentioned in the descriptions, especially where the soil pattern was so complex that it was impractical to make enough observations to identify all of the kinds of soils on the landscape.

The presence of inclusions in a map unit in no way diminishes the usefulness or accuracy of the soil data. The objective of soil mapping is not to delineate pure taxonomic classes of soils but rather to separate the landscape into segments that have similar use and management requirements. The delineation of such landscape segments on the map provides sufficient information for the development of resource plans, but onsite investigation is needed to plan for intensive uses in small areas.

General Soil Map Units

The general soil map at the back of this publication shows broad areas that have a distinctive pattern of soils, relief, and drainage. Each map unit on the general soil map is a unique natural landscape. Typically, a map unit consists of one or more major soils and some minor soils. It is named for the major soils. The soils making up one unit can occur in other units but in a different pattern.

The general soil map can be used to compare the suitability of large areas for general land uses. Areas of suitable soils can be identified on the map. Likewise, areas where the soils are not suitable can be identified.

Because of its small scale, the map is not suitable for planning the management of a farm or field or for selecting a site for a road or a building or other structure. The soils in any one map unit differ from place to place in slope, depth, drainage, and other characteristics that affect management.

1. Stendal-Bonnie-Steff

Deep, nearly level, moderately well drained to poorly drained, medium textured soils; on flood plains

The landscape of this map unit is characterized by nearly level soils in valleys adjacent to uplands (fig. 1). The soils formed in alluvium washed from soils that formed in loess on uplands. Areas of these soils are scattered throughout the county. Perennial and intermittent streams, both natural and dug, cross this map unit. In seasons of heavy rainfall, the streams overflow, flooding most areas of this map unit. Farm buildings, roads, and utility lines are the main structures in this map unit.

This map unit makes up about 5 percent of the county. It is about 50 percent Stendal soils, 25 percent Bonnie soils, 15 percent Steff soils, and 10 percent soils of minor extent.

These soils are silt loam throughout the profile and have a seasonal high water table. Stendal soils are somewhat poorly drained, Bonnie soils are poorly drained, and Steff soils are moderately well drained.

Of minor extent in this map unit are Clifty and Cuba soils on flood plains and Calloway, Zanesville, and Wellston soils on uplands.

The soils of this map unit are used mainly for cultivated crops. In a few areas, they are used for hay or pasture or as woodland. Some areas of Bonnie soils are ponded and are used only for water-tolerant vegetation. Most cultivated areas have been drained. On many farms, the soils of this map unit are used entirely for corn and soybeans.

If these soils are adequately drained, they are suited to cultivated crops. These soils, however, are poorly suited to small grains and other crops that would be damaged by winter floods. Wetness and the hazard of flooding are severe limitations for residential and other urban uses. These soils are well suited to the development of habitat for wildlife. They are poorly suited to intensive recreational uses in wet seasons and well suited to recreational uses in dry seasons.

2. Melvin-Newark-Karnak

Deep, nearly level, somewhat poorly drained and poorly drained, medium textured and fine textured soils; on flood plains

The landscape of this map unit consists of nearly level soils on flood plains and in valleys, mostly along the Rough River and the Green River. These soils formed in mixed alluvium and clayey, slack water deposits. Many intermittent streams are throughout this map unit. In seasons of heavy rainfall, the rivers overflow, flooding most areas of this map unit. Farm buildings, roads, gas transmission lines, power lines, and barge-loading facilities are the important structures in this map unit.

This map unit makes up about 12 percent of the county. It is about 20 percent Melvin soils, 20 percent Newark soils, 10 percent Karnak soils, and 50 percent soils of minor extent.

Melvin and Newark soils formed in alluvium from mixed parent material, are silt loam throughout, and have a seasonal high water table. Melvin soils are poorly drained, and Newark soils are somewhat poorly drained. Karnak soils formed in clayey, slack water deposits, are silty clay or clay throughout, are poorly drained, and have a seasonal high water table.

Of minor extent in this map unit are Pope, Nolin, and Lindside soils on flood plains and Elk, Otwell, Weinbach, Henshaw, and McGary soils on stream terraces.

The soils of this map unit are used mainly for cultivated crops. A few areas are in woodland, hay, or pasture. Most cultivated areas have been drained. On many farms, the soils of this map unit are used entirely for the production of corn and soybeans. Most farm operators live outside the area.

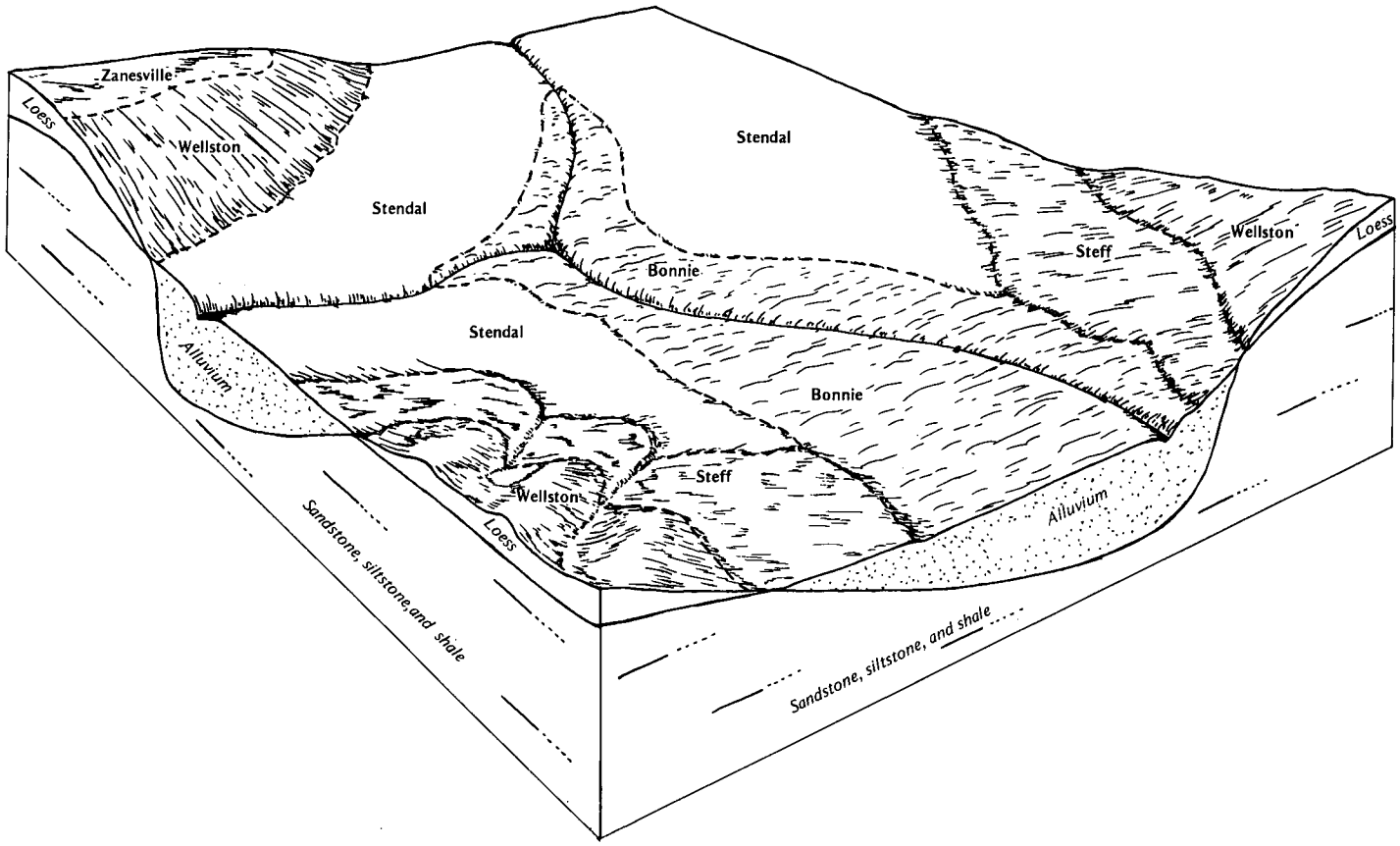


Figure 1.—Typical pattern of soils and underlying material in the Stendal-Bonnie-Steff map unit.

If these soils are adequately drained, they are well suited to most annual summer crops. They are poorly suited to crops, such as tobacco and alfalfa, that require a well drained soil and to small grain crops that would be damaged by winter flooding. Wetness and the hazard of flooding are severe limitations for residential and other urban uses. These soils are well suited to the development of habitat for wildlife. They are poorly suited to intensive recreational uses because of wetness and well suited to extensive recreational uses in dry seasons.

3. Wellston-Zanesville

Deep, gently sloping to moderately steep, well drained and moderately well drained, medium textured soils; on uplands

The landscape of this map unit consists of sloping to moderately steep soils on hillsides and gently sloping and sloping soils on hilltops (fig. 2). These soils formed in thin loess and the underlying residuum. They are underlain by sandstone, siltstone, and shale bedrock of Pennsylvanian age. Areas of these soils are on uplands throughout the county. Many intermittent streams cross this map unit. Most ponds are dug ponds that have embankments. Several small towns, many rural homes, farmsteads, roads, and utility lines are important structures in this map unit.

This map unit makes up about 30 percent of the county. It is about 40 percent Wellston soils, 20 percent Zanesville soils, and 40 percent soils of minor extent.

These soils have a surface layer of silt loam and a subsoil of silt loam or silty clay loam. Wellston soils are on upland side slopes. They are sloping to moderately steep, well drained, and do not have a fragipan. Zanesville soils are mostly on hilltops. They are gently sloping or sloping, moderately well drained and well drained, and have a fragipan.

Of minor extent in this map unit are Hosmer and Frondorf soils on uplands and Bonnie, Stendal, Steff, and Cuba soils on flood plains.

The soils of this map unit are mainly used for general farming. A large part of this map unit has been cultivated and is now in trees or brushy vegetation. Cultivated crops are generally on gently sloping and sloping soils

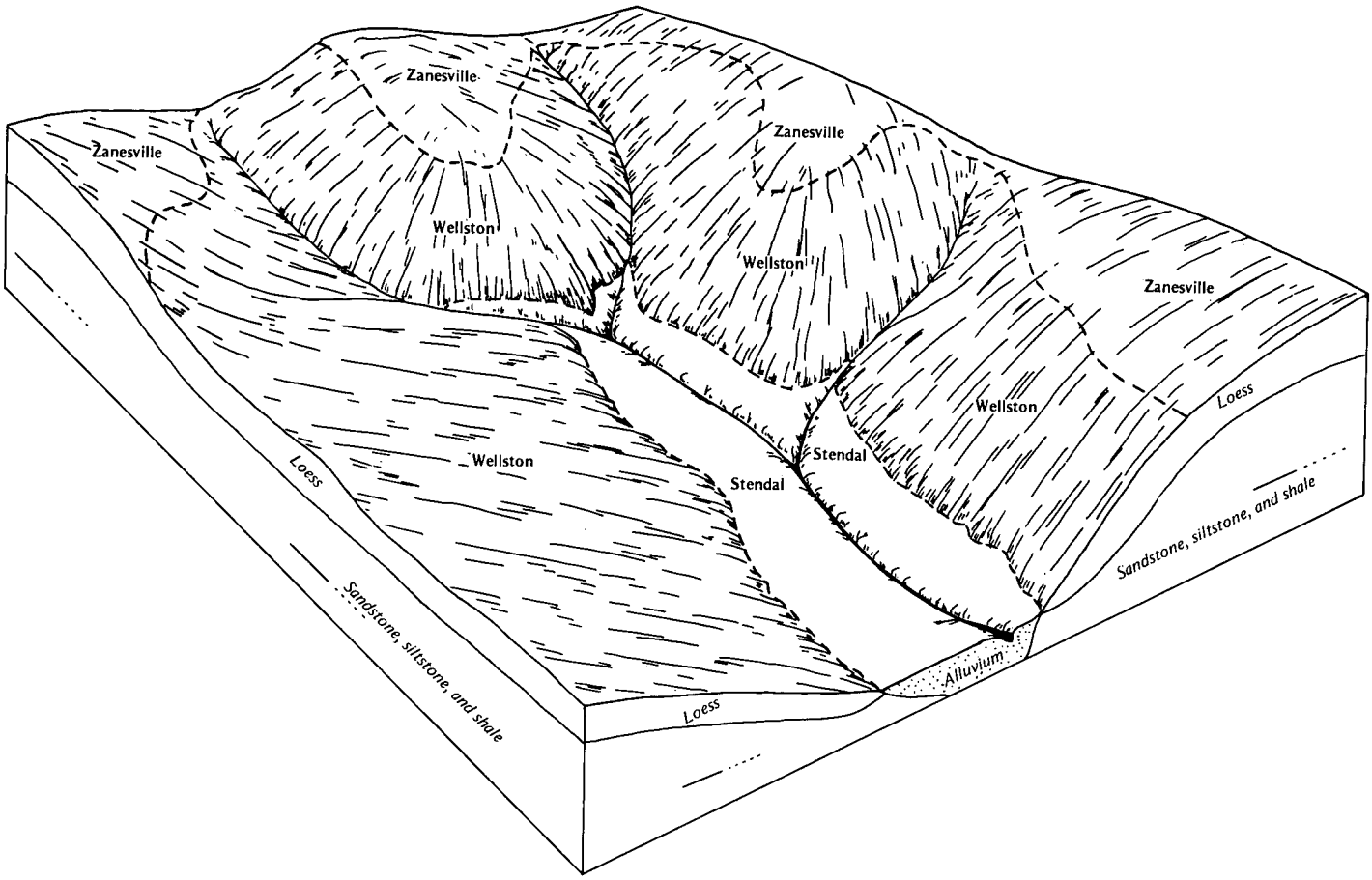


Figure 2.—Typical pattern of soils and underlying material in Wellston-Zanesville map unit.

and on the soils on flood plains. Woodland is generally on moderately steep soils. Hay and pasture are throughout the map unit.

Most of the acreage in this map unit is subject to erosion. The soils on hilltops are well suited to cultivation if practices are used to protect them from erosion. The soils on side slopes are suited to cultivation. Most of the soils are well suited to hay, pasture, woodland, and to the development of habitat for openland and woodland wildlife. These soils are suited to most urban uses. Limitations for urban uses are slope, depth to bedrock, the hazard of erosion, and the slow permeability of Zanesville soils. These soils are suited to intensive recreational uses and are well suited to extensive recreational uses.

4. Hosmer-Zanesville

Deep, gently sloping and sloping, moderately well drained and well drained, medium textured soils; on uplands

The landscape of this map unit consists of gently sloping and sloping soils on uplands (fig. 3) in two small areas in the northwestern part of the county. These soils formed in loess or in loess and the underlying residuum. They are underlain by sandstone, siltstone, and shale bedrock of Pennsylvanian age. Many intermittent streams cross this map unit. Most ponds are dug ponds that have embankments. Rural homes, farmsteads, roads, and utility lines are important structures in this map unit.

This map unit makes up about 1 percent of the county. It is about 55 percent Hosmer soils, 15 percent Zanesville soils, and 30 percent soils of minor extent.

These soils have a silt loam surface layer, a silt loam or silty clay loam subsoil, and a fragipan. Hosmer soils are gently sloping and are on wide ridgetops. Zanesville soils are gently sloping and sloping. They are on narrow hilltops and side slopes.

Of minor extent in this map unit are Wellston and Calloway soils on uplands, Henshaw soils on stream terraces, and Steff and Stendal soils on flood plains.

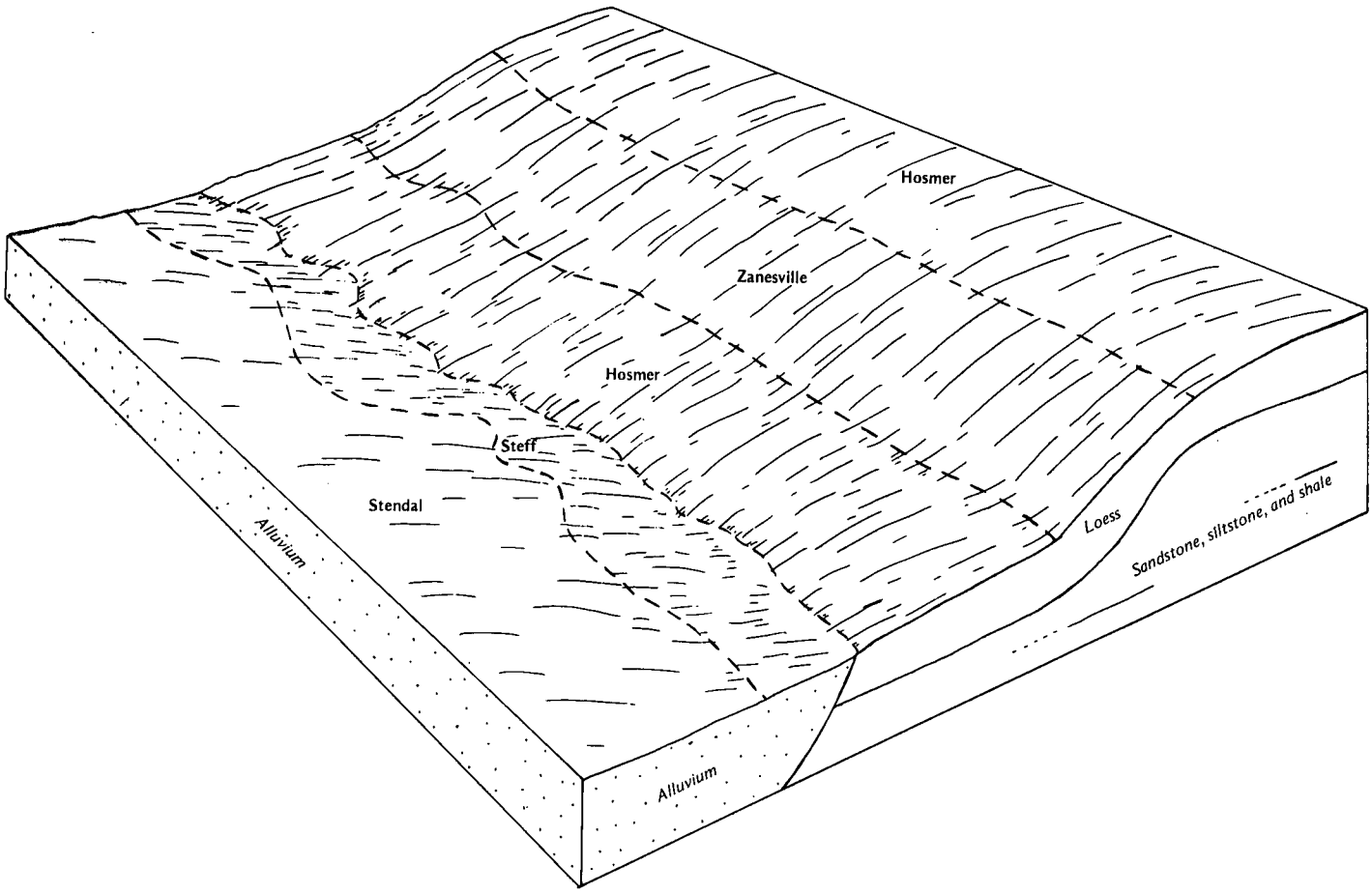


Figure 3.—Typical pattern of soils and underlying material in the Hosmer-Zanesville map unit.

The soils of this map unit are used mostly for general farming. Crops include corn, soybeans, tobacco, hay, and pasture.

These soils are well suited to farming. They are subject to erosion, and if cultivated, erosion control practices are needed. These soils are also well suited to most urban uses; however, they have limitations for some urban uses because of slope, depth to bedrock, and slow permeability in the fragipan. Most of the soils in this map unit are well suited to intensive and extensive recreational uses. These soils are well suited to the development of habitat for wildlife.

5. Frondorf-Zanesville-Wellston

Deep and moderately deep, gently sloping to very steep, well drained and moderately well drained, medium textured soils; on uplands

The landscape of this map unit is characterized by moderately steep to very steep soils on hillsides and gently sloping and sloping soils on hilltops (fig. 4) in the central and eastern parts of the county. These soils formed in thin loess and the underlying residuum. They are underlain by sandstone, siltstone, and shale bedrock of Pennsylvanian age. Many intermittent streams cross this map unit. Most ponds are dug embankment ponds. Small towns, rural homes, farmsteads, roads, and utility lines are the important structures. Most homes and farmsteads are on the gently sloping and slopings soils.

This map unit makes up about 40 percent of the county. It is about 25 percent Frondorf soils, 15 percent Zanesville soils, 15 percent Wellston soils, and 45 percent soils of minor extent.

These soils have a surface layer that is silt loam and a subsoil that is silt loam or silty clay loam. Frondorf and Wellston soils are on side slopes, and Zanesville soils are on hilltops. Zanesville soils are gently sloping or sloping, Wellston soils are sloping to very steep, and Frondorf soils are moderately steep to very steep. Frondorf and Wellston soils are moderately well drained and well drained.

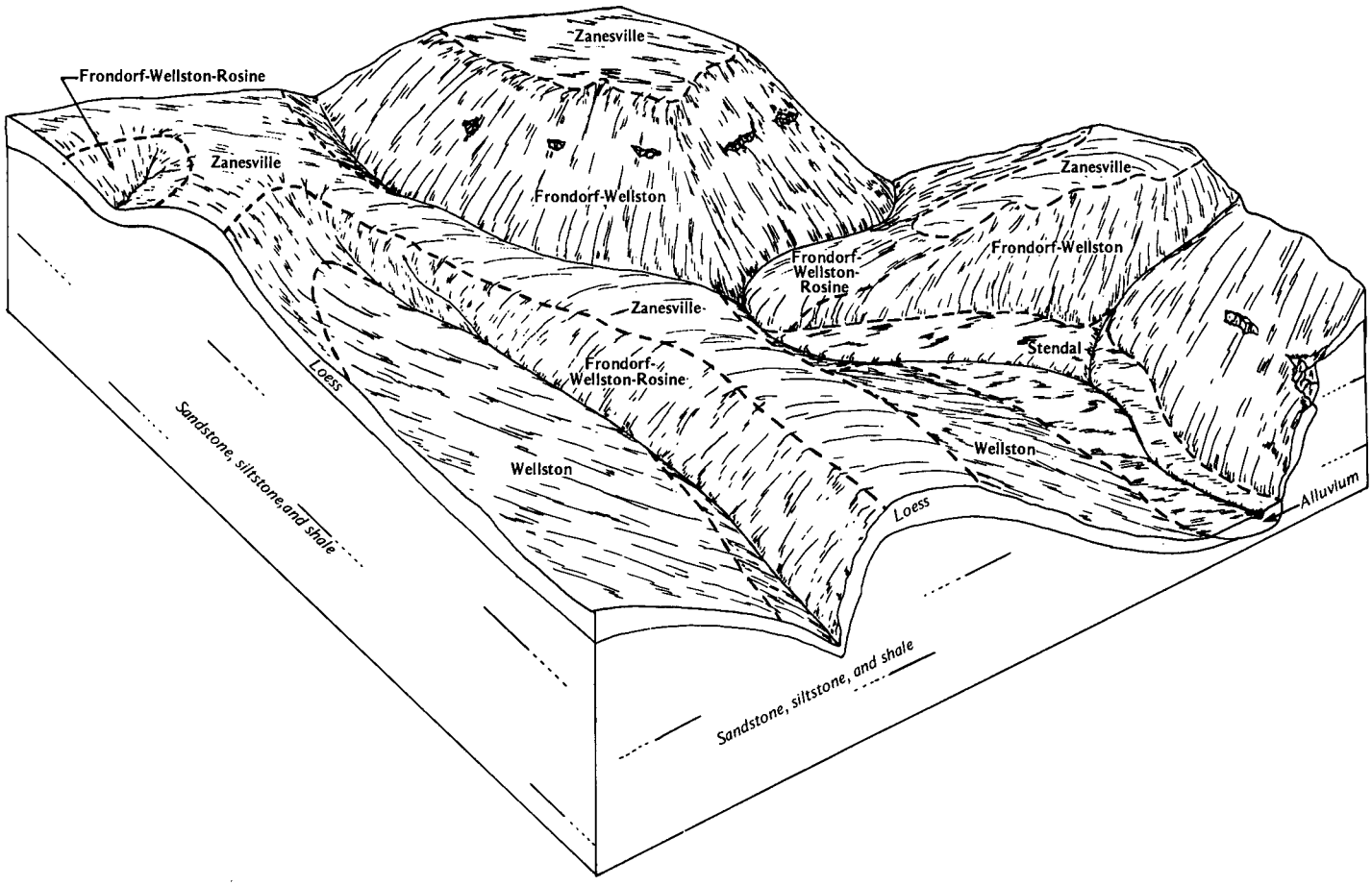


Figure 4.—Typical pattern of soils and underlying material in the Frondorf-Zanesville-Wellston map unit.

Of minor extent in this map unit are Caneyville, Rosine, Sadler, and Calloway soils on uplands and Clifty, Cuba, Steff, Stendal, and Bonnie soils on flood plains.

Most of this map unit is in permanent vegetation. The steep and very steep soils are mostly used as woodland. Some areas of these soils that were farmed are now abandoned and through natural processes are reverting to weeds, brushy growth, and trees. Some areas on hilltops and in valleys are used for cultivated crops, hay, and pasture.

Most soils of this map unit are poorly suited to farming. Some areas are well suited to farming, but they are mostly in small tracts on narrow hilltops or in valleys. Most areas of these soils are poorly suited to urban uses because of slope, depth to bedrock, or slow permeability of the Zanesville soils. These soils are suited to recreational uses. They are poorly suited to habitat for wetland wildlife, suited to habitat for openland wildlife, and well suited to habitat for woodland wildlife.

6. Sadler-Zanesville-Wellston

Deep, gently sloping to steep, moderately well drained and well drained, medium textured soils; on uplands

The landscape is characterized by gently sloping soils on ridgetops and toe slopes separated by sloping to steep soils on side slopes (fig. 5). These soils formed in loess and the underlying residuum weathered from sandstone, siltstone, and shale of Pennsylvanian age. Areas of these soils are on uplands in the central part of the county. Many intermittent streams and dug ponds are in this map unit. Towns, rural homes, farmsteads, and roads are the important structures.

This map unit makes up about 4 percent of the county. It is about 35 percent Sadler soils, 20 percent Zanesville soils, 15 percent Wellston soils, and 30 percent soils of minor extent.

These soils have a surface layer of silt loam and a subsoil of silt loam or silty clay loam. Sadler and Zanesville soils have a fragipan; Wellston soils do not

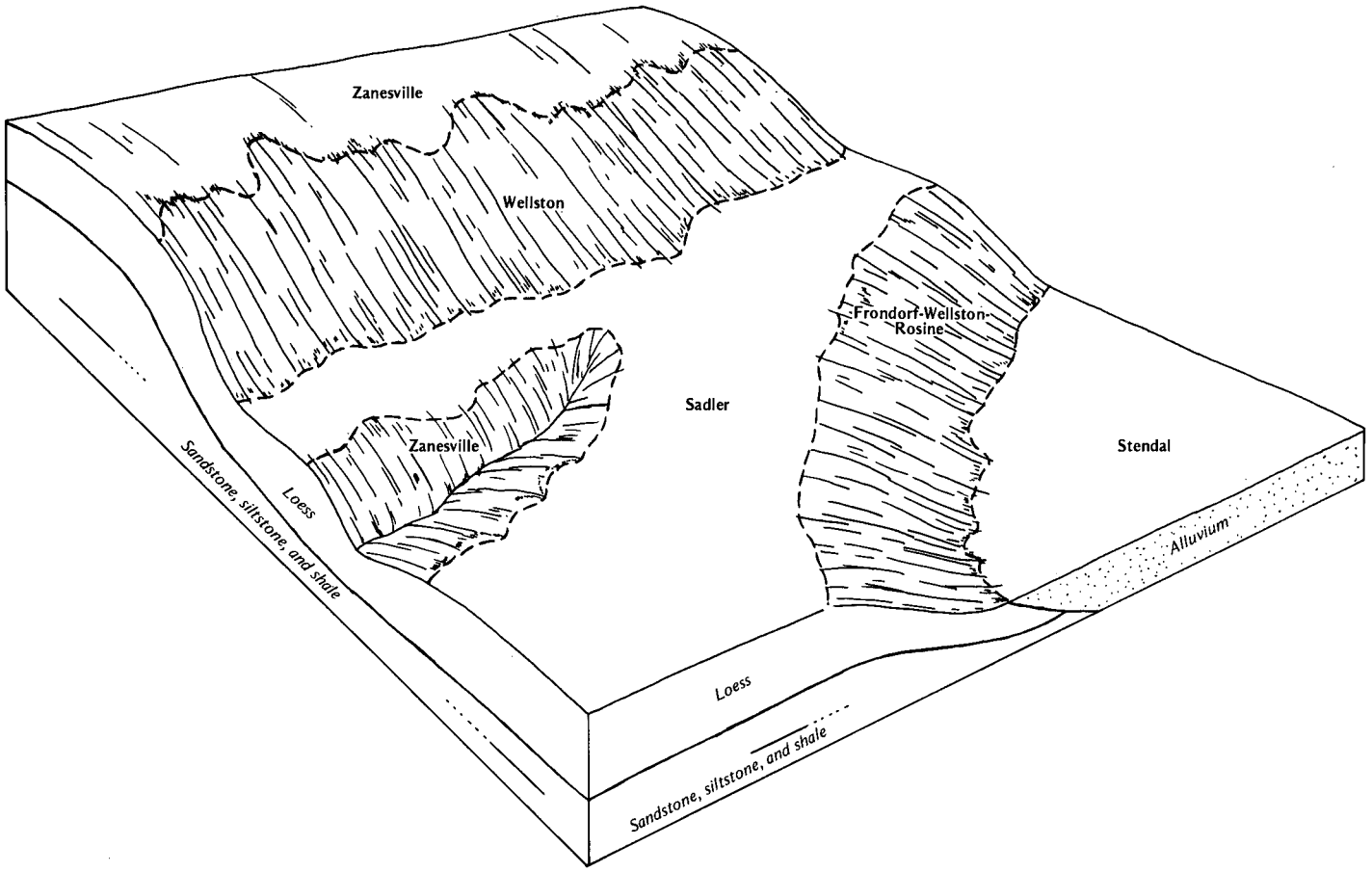


Figure 5.—Typical pattern of soils and underlying material in the Sadler-Zanesville-Wellston map unit.

have a fragipan. Zanesville soils are gently sloping and sloping, moderately well drained and well drained. The gently sloping, moderately well drained Sadler soils are mostly on wide ridgetops. The sloping to steep, well drained Wellston soils are on side slopes.

Of minor extent are Calloway, Hosmer, and Frondorf soils on uplands and Steff, Stendal, and Bonnie soils on flood plains.

The soils of this map unit are used mostly for farming. Crops include corn, soybeans, wheat, tobacco, hay, and pasture. A few small areas are in woodland. Hartford and Beaver Dam are in this map unit.

These soils are suited to farming. They are subject to erosion, and if cultivated, erosion control practices are needed. These soils are also suited to most urban uses; however, they have limitations for some urban uses because of slope, depth to bedrock, and slow permeability of the fragipan. Most of the soils of this map unit are suited to intensive or extensive recreational uses. They are well suited to the development of habitat for wildlife.

7. Bethesda-Fairpoint-Zanesville

Deep, gently sloping to very steep, moderately well drained and well drained, medium textured soils; on uplands

The landscape is characterized by areas of soils that have been disturbed by strip mining separated by soils that have not been disturbed (fig. 6). Areas that have been disturbed have short, very steep slopes in places that have not been graded and gentle slopes in places that have been graded. Areas that have not been disturbed are mostly gently sloping or sloping. The underlying bedrock is sandstone, siltstone, and shale of Pennsylvanian age. Areas of these soils are mostly in the central and southern parts of the county. Many intermittent streams cross this map unit. Water is in pits left after the mining of coal and in embankment ponds in areas of undisturbed soils. Structures include mine tipples in mined areas, houses in undisturbed areas, roads, and utility lines.

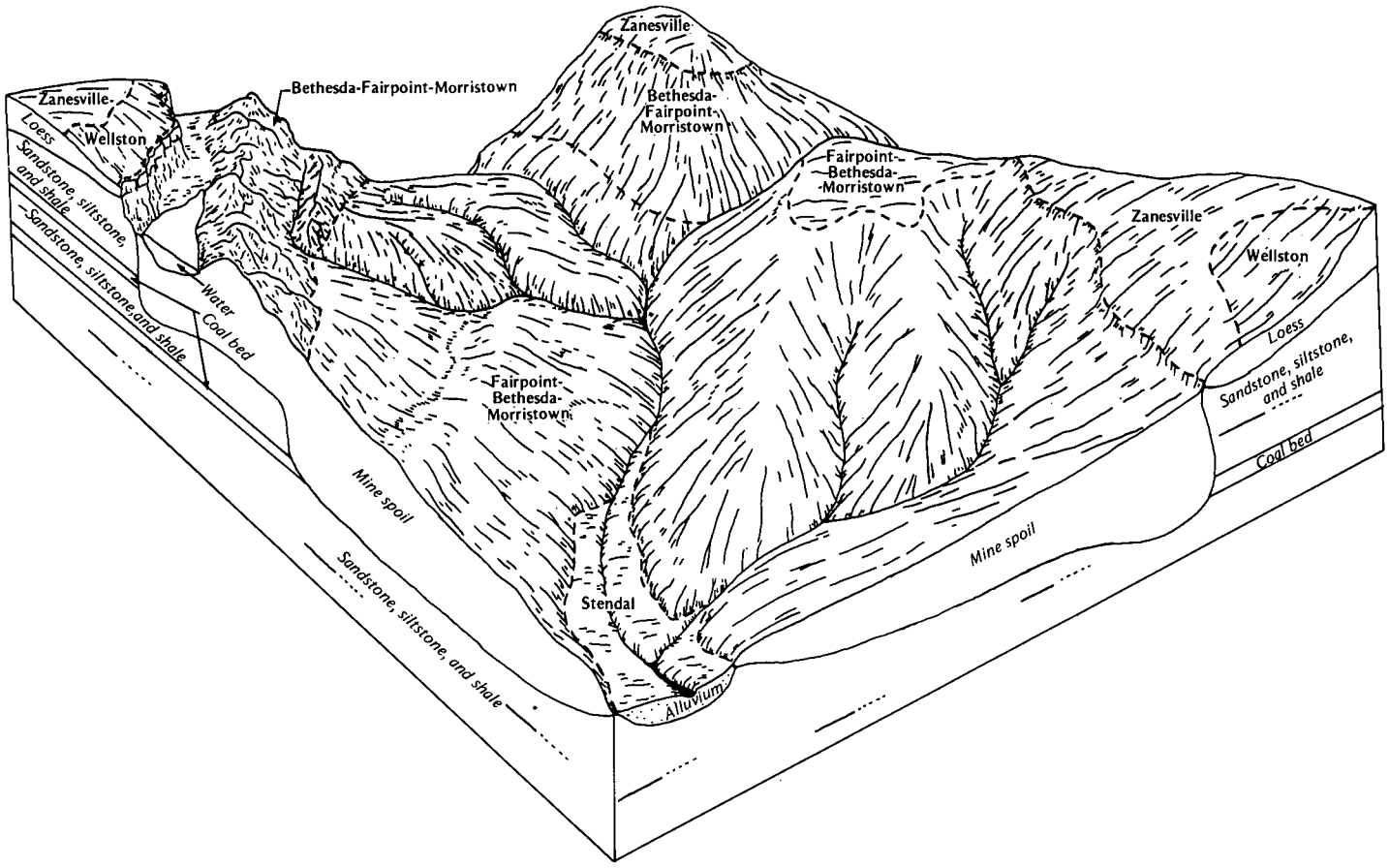


Figure 6.—Typical pattern of soils and underlying material in the Bethesda-Fairpoint-Zanesville map unit.

This map unit makes up about 8 percent of the county. It is about 20 percent Bethesda soils, 20 percent Fairpoint soils, 20 percent Zanesville soils, and 40 percent soils of minor extent.

Bethesda and Fairpoint soils are intermingled on the landscape. They are deep, well drained, medium textured, and variable in slope. Most of these soils have rock fragments and fines that are loamy. Moderately well drained and well drained Zanesville soils are on hilltops in undisturbed areas. They have a surface layer of silt loam and a subsoil of silt loam or silty clay loam and have a fragipan.

Of minor extent in this map unit are Frondorf, Rosine, and Wellston soils on uplands, Clifty, Steff, Stendal, and Bonnie soils on flood plains, and Morristown soils in mined areas. Most mine dumps in the county are in this map unit.

Most of the acreage of this map unit is in trees, brushy plants, or wild vegetation. Most of the land is used for the mining of coal and is owned by coal companies. The few farms in the area are mainly used for part-time general farming.

The soils of this map unit are poorly suited to farming. They are subject to erosion, and Bethesda and Fairpoint soils contain rock fragments. These soils are poorly suited to most urban uses. They are also poorly suited to the development of habitat for wildlife because the soils do not produce good food and vegetative cover. Few people are in the area to disturb the wildlife. The soils of this map unit are suited to intensive recreational uses and well suited to extensive recreational uses.

Detailed Soil Map Units

The map units on the detailed soil maps at the back of this survey represent the soils in the survey area. The map unit descriptions in this section, along with the soil maps, can be used to determine the suitability and potential of a soil for specific uses. They also can be used to plan the management needed for those uses. More information on each map unit, or soil, is given under "Use and Management of the Soils."

Each map unit on the detailed soil maps represents an area on the landscape and consists of one or more soils for which the unit is named.

A symbol identifying the soil precedes the map unit name in the soil descriptions. Each description includes general facts about the soil and gives the principal hazards and limitations to be considered in planning for specific uses.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer or of the underlying material, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer or of the underlying material. They also can differ in slope, stoniness, salinity, wetness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Zanesville silt loam, 2 to 6 percent slopes, eroded, is one of several phases in the Zanesville series.

Some map units are made up of two or more major soils. These map units are called soil complexes or undifferentiated groups.

A *soil complex* consists of two or more soils in such an intricate pattern or in such small areas that they cannot be shown separately on the soil maps. The pattern and proportion of the soils are somewhat similar in all areas. Frondorf-Wellston silt loams, 30 to 50 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils in a mapped area are not uniform. An area can be made up of only one of the major soils, or it can be made up of all of them. Rosine and Caneyville silt loams, 12 to 20 percent slopes, eroded, is an undifferentiated group in this survey area.

Most map units include small scattered areas of soils other than those for which the map unit is named. Some of these included soils have properties that differ substantially from those of the major soil or soils. Such differences could significantly affect use and management of the soils in the map unit. The included soils are identified in each map unit description. Some small areas of strongly contrasting soils are identified by a special symbol on the soil maps.

This survey includes *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Pits, quarry, is an example. Miscellaneous areas are shown on the soil maps. Some that are too small to be shown are identified by a special symbol on the soil maps.

Table 4 gives the acreage and proportionate extent of each map unit. Other tables (see "Summary of Tables") give properties of the soils and the limitations, capabilities, and potentials for many uses. The Glossary defines many of the terms used in describing the soils.

BfF—Bethesda, Fairpoint, and Morristown soils, 20 to 70 percent slopes. This map unit consists of Bethesda, Fairpoint, and Morristown soils in areas that are so intermingled that they could not be mapped separately. These soils are in strip mine spoil that has not been graded and smoothed but remains as it was piled when the overburden was removed from the coal (fig. 7). Most of this map unit is in the southwestern part of the county. Slopes are generally 20 to 50 feet long. Most water does not drain outside the strip mining area. Individual areas range from 5 to 500 acres.

Bethesda soil makes up about 40 percent of the map unit. Typically, the surface layer is dark gray very channery loam about 6 inches thick. The underlying material is grayish brown. It is very gravelly loam to a depth of 21 inches, very channery loam to a depth of 40 inches, and very channery silty clay loam to a depth of 60 inches.

Fairpoint soil makes up about 25 percent of the map unit. Typically, the surface layer is dark brown channery silt loam about 4 inches thick. The underlying material is dark grayish brown channery silt loam to a depth of 20 inches, strong brown silty clay to a depth of 25 inches,

Figure 7.—Mine spoil that has not been graded and smoothed in an area of Bethesda, Fairpoint, and Morristown soils, 20 to 70 percent slopes.

and dark gray and brown channery silt loam to a depth of 60 inches.

Morristown soil makes up about 10 percent of the map unit. Typically, the surface layer is dark gray shaly silt loam about 7 inches thick. The underlying material is dark gray gravelly silt loam to a depth of 50 inches and olive gray cobbly silt loam to a depth of 70 inches.

These soils have a deep root zone. The available water capacity is low, and permeability is moderately slow. Surface runoff is medium. These soils are very low in organic matter content and low in natural fertility. Bethesda soil is strongly acid to extremely acid, Fairpoint soil is medium acid to neutral, and Morristown soil is neutral or mildly alkaline and calcareous.

Included with these soils in mapping are soils that contain few rock fragments and soils that contain more rock fragments. Also included are soils that contain more sand or less clay than these soils, or both. This map unit includes soils that have extremely acid, nonacid, and calcareous layers in the same profile and small areas of soils that are toxic to plants. Along one side of most areas of this map unit is an escarpment of bedrock 30 to 60 feet high, locally known as the highwall. Many of the small bodies of water that are included are adjacent to the highwall. The included soils make up about 25 percent of the map unit.

Most of the soils in this map unit have sparse wild vegetation of trees, shrubs, and weeds, and the vegetative cover is poor. In a few places, pines, locusts,

or other trees have been planted, and the plant cover is good.

These soils are not suited to cultivated crops, hay, or pasture. Even with extensive grading and smoothing these soils are still poorly suited to these uses. Rock fragments interfere with tillage and mowing. Very heavy applications of fertilizer and, in places, lime are necessary to grow grasses and legumes that help to control erosion.

These soils are suited to woodland. Eastern white pine, black locust, yellow-poplar, and loblolly pine are the preferred trees. Because of the short, steep slopes, equipment used for planting and harvesting generally cannot be used without grading and smoothing these soils.

Poor vegetation makes the potential for habitat for wildlife poor. Any planting that provides food and cover is beneficial to wildlife. The habitat can be improved if plants that provide good food and cover are planted in adjacent areas.

These soils are poorly suited to most urban uses because of the steep slopes, rock fragments, and clayey texture. Low strength is a severe limitation for local roads and streets.

This map unit is in capability subclass VIIe. Bethesda and Morristown soils are in woodland suitability group 4r, and Fairpoint soil is in woodland suitability group 3r.

Bo—Bonnie silt loam, occasionally flooded. This deep, nearly level, poorly drained soil is in wide valleys on flood plains. Slopes are 0 to 2 percent. This soil formed in recent alluvium near upland soils that formed in loess. Mapped areas range from 5 to 80 acres.

Typically, the surface layer of this soil is grayish brown silt loam 6 inches thick. The subsoil, to a depth of 40 inches, is light gray silt loam that has yellowish brown mottles. The substratum to a depth of 60 inches or more is light gray silt loam that has yellowish brown mottles.

This soil has moderate permeability. Runoff is slow. The root zone is deep, and the available water capacity is high. The content of organic matter is low, and natural fertility is medium. The surface layer is strongly acid or very strongly acid except in areas that have been limed. This soil has a seasonal high water table and is subject to occasional flooding.

Included with this soil in mapping are a few areas of Stendal soils. Also included are soils that have 18 to 30 percent clay and soils that have 15 to 25 percent fine and medium sand in the subsoil. Soils that are slightly acid in the subsoil are included in some mapped areas. The included soils make up about 15 to 25 percent of the map unit.

Most of this Bonnie soil is either cultivated or in native hardwoods. Cultivated areas are in corn or soybeans.

This soil is suited to cultivated crops. The erosion hazard is slight, and the soil can be cultivated intensively without loss of soil. Flooding generally occurs in winter or spring when crops are not growing. Most row crops that are grown in the area are suited to this soil if it is adequately drained. Crops respond to the use of fertilizer and lime. Important management practices include the use of cover crops and the return of crop residue.

This soil is suited to hay and pasture. It is suited to grasses and legumes that do not require a well drained soil. Drainage to lower the water table improves the suitability of most plants. In places, grasses and legumes are damaged by flooding. Management needs include use of suitable plants, proper seeding, lime and fertilizer, control of weeds, and control of grazing.

This soil is well suited to woodland, and the potential productivity is high. Preferred trees are eastern cottonwood, American sycamore, sweetgum, baldcypress, and pin oak. Equipment limitations, seedling mortality, and plant competition are management concerns.

This soil is poorly suited to urban uses because of the hazard of flooding and the seasonal high water table. Most of this soil is commonly flooded in winter; however, urban improvements generally can be protected by the use of dikes and levees. This soil is usually saturated with water for several weeks in winter. The surplus water can be removed by drainage, but for some uses this may not be practical.

This Bonnie soil is in capability subclass IIIw and in woodland suitability group 2w.

Bp—Bonnie silt loam, ponded. This nearly level soil is in low areas that are covered with water most of the time. Slopes are 0 to 1 percent. The water is 0 to 3 feet deep; it does not drain off because there are no drainage channels or the channels have been blocked. This soil is in wide valleys adjacent to soils on uplands that formed in loess. Most of this soil has been ponded for many years.

Typically, the surface layer is grayish brown silt loam about 6 inches thick. The subsoil, to a depth of 40 inches, is light gray silt loam that has yellowish brown mottles. The substratum to a depth of 60 inches or more is light gray silt loam that has yellowish brown mottles.

Included with this soil in mapping are areas of Karnak, Melvin, and Stendal soils. Also included are areas that have an overwash that contains fragments of sandstone, shale, and coal. The included soils make up 20 to 30 percent of the map unit.

This soil has sparse vegetation of willows, cattails, and water-tolerant shrubs. In places, ponding of water has killed trees that were not water tolerant. Areas of this soil near coal mines receive runoff that may be toxic to some plants. Fish, turtles, and other aquatic animals live in some areas of this map unit.

Unless this soil is drained, it is not suited to cultivated crops or grasses and legumes. Some areas of this soil were cultivated before it became ponded.

This soil has moderate potential productivity for woodland. Equipment use limitations, seedling mortality, and plant competition are management concerns. Unless this soil is drained, it is suited only to water-tolerant trees, such as baldcypress, sweetgum, and pin oak (fig. 8).

This soil is well suited to the development of habitat for wetland wildlife and to some recreational uses.

This soil is not suited to most urban uses because of the water. Even if drained, this soil is poorly suited to most urban uses because of the high water table and the hazard of flooding.

This Bonnie soil is in capability subclass Vw and in woodland suitability group 4w.

Ca—Calloway silt loam. This nearly level, deep, somewhat poorly drained soil is on wide ridgetops and near the base of slopes on uplands. Slopes are mostly 0 to 2 percent but range up to 3 percent. Most areas are 400 to 800 feet in diameter and roughly oval.

Typically, the surface layer of this soil is brown silt loam about 8 inches thick. The subsoil, to a depth of 24 inches, is mottled brown, yellowish brown, and light brownish gray silt loam. Between depths of 24 and 65 inches is a firm, brittle and compact, silty clay loam and silt loam fragipan that is yellowish brown and has light brownish gray mottles.

This soil has moderate permeability above the fragipan and slow permeability in the fragipan. Runoff is slow. The available water capacity is moderate, and the root zone is moderately deep to the fragipan. The organic matter content is low, and natural fertility is medium. This soil is strongly acid or very strongly acid except in areas that have been limed. This soil has good tilth and workability. It has a seasonal high water table above the fragipan.

Figure 8.—Trees that have been killed by excess water on Bonnie silt loam, ponded.

Included with this soil in mapping are small areas of Hosmer, Sadler, and Stendal soils and small areas of poorly drained upland soils. Soils that are 3 to 4 feet to bedrock are included in the southern part of the map unit. The included soils make up about 20 to 30 percent of the map unit.

Most of this Calloway soil is used for corn, hay, and pasture. A few areas are in woodland, and some farm buildings are in this map unit.

This soil is suited to cultivated crops. The erosion hazard is slight, and this soil can be cultivated in short rotation. Because of the seasonal high water table, this soil is not suited to crops that require a well drained soil. Deep-rooted plants have a short life because of the moderately deep root zone and wetness. The soil can be worked over a wide range of moisture conditions without crusting or clodding. Crops respond well to lime and fertilizer. Most of the row crops that are grown in the area are suited to this soil; however, drainage improves the suitability of some crops. Important management practices include use of cover crops and return of crop residue.

This soil is well suited to grasses and legumes that are common to the survey area. However, because of the moderate depth of the root zone and the seasonal high water table, it is not well suited to plants that require a deep, well drained soil. Most plants grow best where the excess water has been removed. Proper seeding, lime and fertilizer, control of grazing, and control of weeds are important management needs.

This soil is well suited to woodland and has high potential productivity. It has equipment limitations because of excess water in wet seasons. Competition from undesirable plants is a management concern. Preferred trees include cherrybark oak, eastern white pine, sweetgum, yellow-poplar, and loblolly pine.

This soil is poorly suited to most urban uses because of the seasonal high water table. The subsoil above the fragipan is generally saturated with water for several weeks in winter. Surplus water can be removed by the use of ditches, but this is not always practical. The slow permeability in the fragipan limits the use of tile drains and septic tank filter fields.

This Calloway soil is in capability subclass IIw and in woodland suitability group 2w.

CcD2—Caneyville silt loam, very rocky, 8 to 20 percent slopes, eroded. This sloping and moderately steep soil is on hillsides in an area that is dissected by deep drainageways. Caneyville soil formed in residuum from limestone. It is below soils that formed in residuum from sandstone, siltstone, and shale. Most areas of this soil are 200 to 600 feet wide and extend 1,000 to 2,000 feet around the hill. About 1 to 10 percent of the area is outcrops of limestone. Slopes are 200 to 600 feet long.

Typically, the surface layer is dark brown silt loam about 5 inches thick. The subsoil, to a depth of 12 inches, is yellowish red clay. To a depth of 30 inches, it is reddish brown clay that has dark brown mottles. Limestone bedrock is at a depth of 30 inches.

This soil has moderately slow permeability. The available water capacity is moderate and the root zone is moderately deep. Depth to bedrock is 20 to 40 inches. The organic matter content is low, and natural fertility is medium. This soil is slightly acid to very strongly acid except in areas that have been limed.

Included with this soil in mapping are small areas of Frondorf, Rosine, and Wellston soils. Also included are soils that are more shallow to bedrock than Caneyville soil and soils that are deeper to bedrock. Soils that have more clay in the surface layer and soils that have more coarse fragments in the surface layer than Caneyville soil are included. A few small areas that are severely eroded are included. The included soils make up 15 to 25 percent of the map unit. In a few places, the map unit includes loose stones and boulders.

Because of the steep slopes and the rock outcrops, this soil is poorly suited to cultivation. Most areas are poorly suited to pasture because of the difficulty of mowing and renovation. The hazard of erosion is very severe. This soil is suited to permanent vegetation. Areas that can be seeded and maintained are suited to most of the grasses and legumes commonly grown. Crops respond to lime and fertilizer.

This soil is suited to woodland, and the potential productivity is moderately high. Most areas are in woodland. Preferred trees include white oak and yellow-poplar on the cool slopes and Virginia pine and eastern redcedar on the hot slopes. Rock outcrops and steep slopes interfere with the use of harvesting equipment. Also, erosion is a hazard along haul roads and skid trails.

This soil is poorly suited to most urban uses because of the depth to bedrock, slope, clayey texture of the subsoil, and the presence of rock outcrops. The steep slopes are a severe limitation for most uses. On the steep slopes, considerable cutting and filling is necessary for buildings, but the bedrock severely limits the amount of excavating and cutting that can be done. Shrinking and swelling and low strength as it affects local roads and streets are also limitations, but they can be overcome by good design and proper installation.

This Caneyville soil is in capability subclass VIs and in woodland suitability groups 3x (north slopes) and 4x (south slopes).

Ct—Clifty gravelly silt loam, occasionally flooded. This deep, nearly level, well drained soil is on flood plains. Slopes are mostly 0 to 2 percent. This soil is in narrow valleys adjacent to steep soils on uplands. Most of this soil is in the southern part of the county. Individual areas are generally 200 to 1,000 feet wide, 1,000 to 5,000 feet long, and about 5 to 25 acres.

Typically, the surface layer is brown gravelly silt loam about 9 inches thick. The subsoil, to a depth of 38

inches, is dark yellowish brown and yellowish brown gravelly silt loam. The substratum to a depth of 60 inches or more is yellowish brown gravelly loam.

This soil has moderately rapid permeability. Runoff is slow. The root zone is deep, and the available water capacity is moderate. This soil is low in organic matter content and medium in natural fertility. It is strongly acid or very strongly acid except in areas that have been limed. This soil is subject to occasional flooding.

Included with this soil in mapping are small areas of Cuba, Steff, and Stendal soils. Also included are small areas of moderately well drained and somewhat poorly drained, gravelly soils and soils that have 35 to 50 percent gravel in the subsoil. The included soils make up 15 to 25 percent of the map unit.

This Clifty soil is used for corn, hay, and pasture. Some areas in narrow valleys are in woodland.

This soil is well suited to cultivated crops. The erosion hazard is slight. This soil can be cultivated in short rotations without loss of soil. It is flooded for short periods generally in winter or in spring when row crops are not growing. Most crops respond to lime and fertilizer. Coarse fragments in the plow layer interfere with tillage in some places. Use of cover crops and return of crop residue increase the content of organic matter and improve the tilth.

This soil is suited to hay and pasture. It is suited to most grasses and legumes that are grown in the survey area. In some years, perennials are damaged by floods in winter and spring. The main management needs are proper seeding mixtures and rates, lime and fertilizer, control of weeds, and rotation of pasture.

This soil is well suited to woodland, and the potential productivity is high. Preferred trees include yellow-poplar, sweetgum, white ash, shortleaf pine, white oak, eastern white pine, northern red oak, and loblolly pine. There is competition from undesirable trees.

This soil is poorly suited to many urban uses because of the hazard of flooding. Generally it is flooded for short periods in winter and spring. This hazard can be overcome by the use of dikes or levees, but this is expensive. The moderately rapid permeability permits seepage; and contamination of wells, water courses, and other water sources is a possibility if this soil is used for sanitary facilities. Also the coarse fragments interfere with some uses if there is foot traffic.

This Clifty soil is in capability subclass IIs and in woodland suitability group 2o.

Cu—Cuba silt loam, occasionally flooded. This deep, nearly level, well drained soil is on flood plains. Slopes are mostly 0 to 2 percent. This soil is in narrow valleys, at the foot of hills, or along large streams. It formed in recent alluvium and is adjacent to upland soils that formed in loess. Mapped areas range from 10 to 30 acres.

Typically, the surface layer of this soil is dark brown silt loam 8 inches thick. The subsoil, to a depth of 24 inches, is yellowish brown silt loam. The substratum to a depth of 60 inches or more is brown silt loam that has mottles of grayish brown and dark brown in the lower part.

This soil has moderate permeability. Runoff is slow. The root zone is deep, and the available water capacity is high. This soil is low in organic matter content and medium in natural fertility. It is strongly acid or very strongly acid except in areas that have been limed. It is subject to occasional flooding.

Included with this soil in mapping are small areas of Clifty, Lindside, Nolin, Steff, and Stendal soils. Also included are soils that contain more sand, soils that are stratified, soils that contain more clay in the subsoil, and soils that contain up to 15 percent coarse fragments. The included soils make up about 10 to 20 percent of the map unit.

Most of this Cuba soil is used to produce corn, soybeans, and hay. A few areas are in woodland.

This soil is well suited to cultivated crops. The erosion hazard is slight, and this soil can be cultivated in short rotations without loss of soil. This soil is subject to occasional flooding, generally of short duration, in winter or in spring when row crops are not growing. Most crops respond to lime and fertilizer. The plow layer is easy to till and can be worked over a wide range of moisture content. Use of cover crops and return of crop residue increase the content of organic matter and improve the tilth.

This soil is suited to hay and pasture. It is suited to most grasses and legumes that are grown in the survey area. Management needs include proper seeding mixtures and rates, lime and fertilizer, control of weeds, and control of grazing. In some places, perennials are damaged by floods.

This soil is well suited to woodland, and the potential productivity is very high. Preferred trees include eastern white pine, black walnut, yellow-poplar, white oak, northern red oak, shortleaf pine, white ash, and loblolly pine. Tree seeds and seedlings survive and grow well if competing trees, shrubs, and vines are controlled or removed.

This soil is poorly suited to most urban uses because of the hazard of flooding. Generally, it is flooded for short periods in winter and spring. In most places, urban structures can be protected from flooding by the use of dikes and levees.

This Cuba soil is in capability subclass IIw and in woodland suitability group 1o.

Du—Dumps, mine. This miscellaneous area consists of waste material from coal mines. The material is coal, shale, and other material that has been brought out of the mines with the coal. It is separated from the coal as impurities at the tipple. The material is several feet thick,

and most of it has been graded so slopes are 0 to 6 percent.

The material is extremely acid and contains substances that are toxic to plants. In most places, there is no vegetation. Most of the material also contains substances that are corrosive to metal. Around active mines, the dumps are sometimes used as temporary sites for buildings, roads, and parking lots. They are severely limited for urban use because of coarse fragments, corrosivity, and toxicity. Runoff of water is rapid, and in places runoff contributes toxic water and sediment to adjacent, lower-lying soils.

This map unit is in capability subclass VIIIs. It is not assigned to a woodland suitability group.

EkA—Elk silt loam, 0 to 2 percent slopes. This deep, nearly level, well drained soil is mostly on stream terraces in the Green River Valley. It is on low, narrow ridges roughly parallel to the river. Most areas are 400 to 600 feet wide and 1,000 to 3,000 feet long.

Typically, the surface layer is dark brown silt loam about 9 inches thick. The subsoil extends to a depth of 50 inches. The upper part is brown silt loam, and the lower part is strong brown silt loam. The substratum to a depth of 60 inches or more is mottled strong brown and yellowish brown silt loam.

This soil has moderate permeability. Runoff is medium. The root zone is deep, and the available water capacity is high. This soil is low in organic matter content and medium to high in natural fertility. It is medium acid to very strongly acid except in areas that have been limed. Most areas of this soil are rarely flooded; a few areas are occasionally flooded.

Included with this soil in mapping are small areas of Otwell soils. Also included are soils that have more sand throughout the profile than the Elk soil. The included soils make up about 10 to 20 percent of the map unit.

Most of this Elk soil is used to produce corn, soybeans, and hay. A few small areas are in woodland.

This soil is well suited to cultivated crops; however, if this soil is cultivated, erosion is a slight hazard. This soil is suited to most of the cultivated crops that are grown in the survey area. Crops respond to lime and fertilizer. The plow layer is easy to till and can be worked over a wide range of moisture content. If this soil is cultivated, conservation tillage, cover crops, addition of organic matter, and grasses and legumes in the rotation system improve the tilth and increase yields.

This soil is well suited to most grasses and legumes that are grown in the survey area, but some perennials are damaged by winter floods. The main management needs are proper seeding rates and mixtures, lime and fertilizer, control of weeds, and control of grazing.

This soil is well suited to woodland, and the potential productivity is high. Most trees that grow in the area are well suited to this soil, and there is competition from undesirable trees. Preferred trees include eastern white pine, shortleaf pine, yellow-poplar, black walnut, loblolly pine, white oak, white ash, and cherrybark oak.

This soil is suited to most urban uses. The main limitation is the hazard of flooding. Floods are rare, but they last for several days. Permanent structures can be protected from floods by the use of dikes and levees.

This Elk soil is in capability class I and in woodland suitability group 2o.

EkB2—Elk silt loam, 2 to 6 percent slopes, eroded. This deep, gently sloping, well drained soil is mostly on stream terraces in the Green River Valley. It is on low, narrow ridges roughly parallel to the river. Most areas are 400 to 600 feet wide and 1,000 to 3,000 feet long. Slopes are generally 200 to 300 feet long.

Typically, the surface layer is dark brown silt loam about 9 inches thick. The subsoil extends to a depth of 50 inches. The upper part is brown silt loam, and the lower part is strong brown silt loam. The substratum to a depth of 60 inches or more is mottled strong brown and yellowish brown silt loam.

This soil has moderate permeability. Runoff is medium. The root zone is deep, and the available water capacity is high. This soil is low in organic matter content and medium to high in natural fertility. This soil is strongly acid or very strongly acid except in areas that have been limed. Most areas of this soil are rarely flooded; a few areas are occasionally flooded.

Included with this soil in mapping are small areas of Otwell soils. Soils that have more sand throughout the profile than Elk soil are included. Also included are small areas of Elk soils; some have slopes of 2 to 12 percent and are not eroded and others have slopes of 6 to 12 percent and are severely eroded. These areas are shown with special symbols. The included soils make up about 10 to 20 percent of the map unit.

Most of this Elk soil is used to produce corn, soybeans, and hay. A few small areas are in woodland.

This soil is well suited to cultivated crops; however, if this soil is cultivated, erosion is a moderate hazard. This soil is suited to most of the cultivated crops that are grown in the survey area. Crops respond to the use of lime and fertilizer. The plow layer is easy to till and can be worked over a wide range of moisture content. If this soil is cultivated, conservation tillage, contour cultivation, stripcropping, cover crops, addition of organic matter, grassed waterways, and grasses and legumes in the rotation system reduce runoff and help control erosion.

This soil is well suited to most grasses and legumes that are grown in the survey area, but some perennials are damaged by winter floods. The main management needs are proper seeding rates and mixtures, lime and fertilizer, control of weeds, and control of grazing.

This soil is well suited to woodland, and the potential productivity is high. Most trees that grow in the survey area will grow on this soil, but there is competition from undesirable trees. Preferred trees include eastern white

pine, shortleaf pine, cherrybark oak, white oak, white ash, yellow-poplar, black walnut, and loblolly pine.

This soil is suited to most urban uses. The main limitation is the hazard of flooding. Floods are rare, but they last for several days. Permanent structures can be protected from floods by the use of dikes and levees.

This Elk soil is in capability subclass IIe and in woodland suitability group 2o.

FbB—Fairpoint, Bethesda, and Morristown silt loams, 0 to 6 percent slopes. This map unit consists of Fairpoint, Bethesda, and Morristown soils in areas that are so intermingled that they could not be mapped separately. These soils are in strip mine spoil that has been graded, smoothed, and covered with topsoil. Most of these soils have been strip-mined since 1977. Most of this map unit is in the southwestern part of the county. Slopes are generally 200 to 600 feet long. Individual areas range from 5 to 20 acres.

Fairpoint soil makes up about 30 percent of the map unit. Typically, the surface layer is brown silt loam about 8 inches thick. The underlying material extends to a depth of 68 inches. The upper part is dark grayish brown channery silt loam, the middle part is strong brown silty clay, and the lower part is dark gray and brown channery silt loam.

Bethesda soil makes up about 25 percent of the map unit. Typically, the surface layer is brown silt loam about 8 inches thick. The underlying material is dark gray very channery loam to a depth of 14 inches, grayish brown very gravelly loam to a depth of 29 inches, grayish brown very channery loam to a depth of 48 inches, and grayish brown very channery silty clay loam to a depth of 68 inches.

Morristown soil makes up about 25 percent of the map unit. Typically, the surface layer is brown silt loam about 8 inches thick. The underlying material is dark gray gravelly silt loam to a depth of 58 inches and olive gray cobbly silt loam to a depth of 78 inches.

These soils have a deep root zone. The available water capacity is low, and permeability is moderately slow. These soils are low in organic matter content and natural fertility. Surface runoff is medium. Fairpoint soil is medium acid to neutral, Bethesda soil is strongly acid to extremely acid, and Morristown soil is neutral or mildly alkaline and calcareous.

Included with these soils in mapping are soils that contain only a few rock fragments and soils that contain more rock fragments than the Fairpoint, Bethesda, and Morristown soils. Also included are soils that contain more sand and soils that are more clayey. Soils that are toxic to plants are included. In places, the natural soil material that is spread over the mine spoil is thicker than 12 inches, and in other places it contains rock fragments and is strongly acid or very strongly acid. Soils that have extremely acid, nonacid, and calcareous layers in the same profile are included. The included soils make up about 20 percent of the map unit.

Most of the soils in this map unit are used for grasses and legumes. Most areas have been limed, fertilized, and planted to close-growing vegetation to control erosion.

These soils are poorly suited to cultivated crops. Because the thickness of the layer of original soil material that covers the mine spoil varies, cultivation can work rock fragments into the plow layer in places. Also, these soils are highly erodible, and erosion exposes the underlying material. Contour cultivation, conservation tillage, cover crops, stripcropping, and the addition of organic matter help to control erosion.

These soils are suited to hay and pasture. They are suited to most of the grasses and legumes that are grown in the survey area. The main management needs are proper seeding rates and mixtures, lime and fertilizer, control of weeds, and control of grazing.

These soils are well suited to woodland. Most trees that grow in the survey area will grow on these soils. Undesirable trees also grow but can be controlled or removed by site preparation, spraying, cutting, or girdling. Preferred trees include eastern white pine, black locust, yellow-poplar, and loblolly pine.

These soils are suited to most urban uses. Because these soils are above the flood plain and have gentle slopes, they are desirable as sites for buildings. The moderately slow permeability is a severe limitation for septic tank filter fields. The rock fragments in the underlying material interfere with excavation. If rock fragments are left on the surface after the spoil has been graded, smoothed, and covered with topsoil, they can interfere with other urban uses. These soils may settle in the first few years after mining and grading are completed.

This map unit is in capability subclass IVs. Fairpoint soil is in woodland suitability group 3r; Bethesda and Morristown soils are in woodland suitability group 4r.

FbD—Fairpoint, Bethesda, and Morristown silt loams, 6 to 20 percent slopes. This map unit consists of Fairpoint, Bethesda, and Morristown soils in areas that are so intermingled that they could not be mapped separately. These soils are in strip mine spoil that has been graded, smoothed, and covered with topsoil. Most of these soils have been strip-mined since 1977. Most of this map unit is in the southwestern part of the county. Slopes are generally 200 to 600 feet long. Individual areas range from 5 to 50 acres.

Fairpoint soil makes up about 30 percent of the map unit. Typically, the surface layer is brown silt loam about 8 inches thick. The underlying material extends to a depth of 68 inches. The upper part is dark grayish brown channery silt loam, the middle part is strong brown silty clay, and the lower part is dark gray and brown channery silty clay loam.

Bethesda soil makes up about 25 percent of the map unit. Typically, the surface layer is brown silt loam about 8 inches thick. The underlying material is dark gray very channery loam to a depth of 14 inches, grayish brown very gravelly loam to a depth of 29 inches, grayish brown very channery loam to a depth of 48 inches, and grayish brown very channery silty clay loam to a depth of 68 inches.

Morristown soil makes up about 25 percent of the map unit. Typically, the surface layer is brown silt loam about 8 inches thick. The underlying material is dark gray gravelly silt loam to a depth of 58 inches and olive gray cobbly silt loam to a depth of 78 inches.

These soils have a deep root zone. The available water capacity is low, and permeability is moderately slow. These soils are low in organic matter content and natural fertility. Surface runoff is medium. Fairpoint soil is medium acid to neutral, Bethesda soil is strongly acid to extremely acid, and Morristown soil is neutral or mildly alkaline and calcareous.

Included with these soils in mapping are soils that contain only a few rock fragments and soils that contain more rock fragments than the Fairpoint, Bethesda, and Morristown soils. Soils that contain more sand and soils that are more clayey than these soils are also included. This map unit includes soils that have extremely acid, nonacid, and calcareous layers in the same soil profile and soils that are toxic to plants. In a few places, the natural soil material that is spread over the mine spoil is thicker than 12 inches and contains rock fragments. Mounds of stockpiled topsoil several feet thick are included in this map unit. Also included are areas of soils that have slopes of more than 20 percent. The included soils make up about 20 percent of the map unit.

Most of the soils in this map unit are used for grasses and legumes. Most areas have been limed, fertilized, and planted to close-growing vegetation to control erosion.

Generally, cultivation is not practical on these soils. Because the thickness of the layer of original soil material that covers the mine spoil varies, cultivation can work rock fragments into the plow layer in places. Also, these soils are highly erodible, and erosion exposes the underlying material. If these soils are cultivated, contour cultivation, conservation tillage, cover crops, stripcropping, and the addition of organic matter help to control erosion.

These soils are suited to hay and pasture. They are suited to most of the grasses and legumes that are grown in the survey area. The main management needs are proper seeding rates and mixtures, lime and fertilizer, control of weeds, control of grazing, and control of erosion during seedbed preparation.

These soils are well suited to woodland. Most trees that grow in the survey area will grow on these soils. Eastern white pine, black locust, yellow-poplar, and loblolly pine are preferred trees. Undesirable trees also grow but can be controlled or removed by site preparation, spraying, cutting, or girdling.

These soils are suited to most urban uses. Because these soils are above the flood plain, they are desirable as sites for buildings. The moderately slow permeability and slope are severe limitations for septic tank filter fields. The rock fragments in the underlying material interfere with excavation. If rock fragments are left on the surface after the spoil is covered, smoothed, and covered with topsoil, they can interfere with other urban uses. These soils may settle in the first few years after mining and grading are completed.

This map unit is in capability subclass VIs. Fairpoint soil is in woodland suitability group 3r; Bethesda and Morristown soils are in woodland suitability group 4r.

FmB—Fairpoint, Bethesda, and Morristown soils, 0 to 6 percent slopes. This map unit consists of Fairpoint, Bethesda, and Morristown soils in areas that are so intermingled that they could not be mapped separately. These soils are in strip mine spoil that has been graded and smoothed. They consist of a mixture of fine earth and rock fragments. Most of this map unit is in the southwestern part of the county. Slopes are generally 200 to 600 feet long. Individual areas range from 5 to 100 acres.

Fairpoint soil makes up about 40 percent of the map unit. Typically, the surface layer is dark brown channery silt loam about 4 inches thick. The underlying material is dark grayish brown channery silt loam to a depth of 20 inches, strong brown silty clay to a depth of 25 inches, and dark grayish brown and brown channery silt loam to a depth of 60 inches.

Bethesda soil makes up about 25 percent of the map unit. Typically, the surface layer is dark gray very channery loam about 6 inches thick. The underlying material is grayish brown. It is very gravelly loam to a depth of 21 inches, very channery loam to a depth of 40 inches, and very channery silty clay loam to a depth of 60 inches.

Morristown soil makes up about 15 percent of the map unit. Typically, the surface layer is dark gray channery silt loam about 7 inches thick. The underlying material, to a depth of 50 inches, is dark gray gravelly silt loam. To a depth of 70 inches, it is olive gray cobbly silt loam.

These soils have a deep root zone. The available water capacity is low, and permeability is moderately slow. Surface runoff is medium. These soils are very low in organic matter content and natural fertility. Bethesda soil is strongly acid to extremely acid, Fairpoint soil is medium acid to neutral, and Morristown soil is neutral or mildly alkaline and calcareous.

Included with these soils in mapping are soils that contain more fragments of bedrock and soils that contain fewer fragments than the Fairpoint, Bethesda, and Morristown soils. Also included are soils that contain more sand and soils that contain more clay. This map

unit includes small areas of a soil that is more acid and is toxic to most plants. Soils that have extremely acid, nonacid, and calcareous layers in the same profile are also included. Contrasting inclusions are within a few feet of each other. The included soils make up about 20 percent of the map unit.

Most of the soils in this map unit are used for grasses, legumes, or young trees. Most areas have been limed, fertilized, and planted to control erosion.

These soils are poorly suited to cultivated crops. Rock fragments interfere with cultivation, and extremely acid material has low productivity.

These soils are suited to pasture and hayland. Most grasses and legumes grown in the survey area will grow on these soils. Coarse fragments and large stones restrict the use of tillage implements, and settling is irregular in places. Vegetative treatment that provides for a quick, protective, and permanent cover for these soils helps control erosion. In seeding the areas, the spoil can be graded smooth enough to use equipment in planting, harvesting, and maintaining vegetation.

These soils are suited to woodland. Eastern white pine, black locust, yellow-poplar, and loblolly pine are the preferred trees. Good quality planting stock is required for maximum survival and growth. Seedling mortality is a management concern on these soils.

Areas that are graded, seeded, and planted to either herbaceous or woody plants have potential as wildlife food or cover. Any planting that provides adequate vegetative cover to control soil erosion is beneficial to wildlife for food and cover. Strip plantings of herbaceous plants and trees are more attractive than solid plantings. Good plant cover requires maintenance, including applications of fertilizer and reseeding and replanting spots where the vegetation failed to become established.

These soils have moderate to severe limitations for most urban uses. The soils above the flood plain and on gentle slopes are desirable as sites for buildings. The moderately slow permeability is a severe limitation for septic tank absorption fields. Rock fragments interfer with most uses. These soils are subject to subsidence, especially for the first few years after mining.

This map unit is in capability subclass VIs. Fairpoint soil is in woodland suitability group 3r; Bethesda and Morristown soils are in woodland suitability group 4r.

FmD—Fairpoint, Bethesda, and Morristown soils, 6 to 20 percent slopes. This map unit consists of Fairpoint, Bethesda, and Morristown soils in areas that are so intermingled that they could not be mapped separately. These soils are in strip mine spoil that has been graded and smoothed (fig. 9). They consist of a mixture of fine earth and rock fragments. Most of this map unit is in the southwestern part of the county. Slopes are generally 200 to 600 feet long. Individual areas range from 5 to 50 acres.

Fairpoint soil makes up about 40 percent of the map unit. Typically, the surface layer is dark brown channery silt loam about 4 inches thick. The underlying material is dark grayish brown channery silt loam to a depth of 20 inches, strong brown silty clay to a depth of 25 inches, and dark gray and brown channery silt loam to a depth of 60 inches.

Bethesda soil makes up about 25 percent of the map unit. Typically, the surface layer is dark gray very channery loam about 6 inches thick. The underlying material is grayish brown. It is very gravelly loam to a depth of 21 inches, very channery loam to a depth of 40 inches, and very channery silty clay loam to a depth of 60 inches.

Morristown soil makes up about 15 percent of the map unit. Typically, the surface layer is dark gray shaly silt loam about 7 inches thick. The underlying material, to a depth of 50 inches, is dark gray gravelly silt loam. To a depth of 70 inches, it is olive gray cobbly silt loam.

These soils have a deep root zone. The available water capacity is low, and permeability is moderately slow. Surface runoff is medium. These soils are very low in organic matter content and low in natural fertility. Bethesda soil is strongly acid to extremely acid, Fairpoint soil is medium acid to neutral, and Morristown soil is neutral or mildly alkaline and calcareous.

Included with these soils in mapping are soils that contain more fragments of bedrock and soils that contain fewer fragments than the Fairpoint, Bethesda, and Morristown soils. Soils that contain more sand and soils that contain more clay are also included. This map unit includes small areas of a soil that is more acid and is toxic to most plants and soils that have extremely acid, nonacid, and calcareous layers in the same profile. Contrasting inclusions are within a few feet of each other. Small areas of soils that have slopes of more than 20 percent are also included. The included soils make up about 20 percent of the map unit.

Most of the soils in this map unit are used for grasses, legumes, or young trees. Most areas have been limed, fertilized, and planted to control erosion.

These soils are poorly suited to cultivated crops. Rock fragments interfer with cultivation, and extremely acid material has low productivity.

These soils are suited to pasture and hayland. Most grasses and legumes grown in the area will grow on these soils. Coarse fragments and large stones restrict the use of tillage implements, and settling is irregular in places. Vegetative treatment that provides for a quick, protective, and permanent cover for these soils helps control erosion. In seeding the areas, the spoil can be graded smooth enough to use equipment in planting, harvesting, and maintaining vegetation.

These soils are suited to woodland. Eastern white pine, black locust, yellow-poplar, and loblolly pine are the preferred trees. Good quality planting stock is required for maximum survival and growth. Seedling mortality is a

Figure 9.—Fairpoint, Bethesda, and Morristown soils, 6 to 20 percent slopes, in strip mine spoil that has been graded and smoothed after mining.

management concern. The steeper areas have equipment limitations, and erosion is a hazard.

Areas that are graded, seeded, and planted to either herbaceous or woody plants have potential as wildlife food or cover. Any planting that provides adequate vegetative cover to control soil erosion is beneficial to wildlife for food and cover. Strip plantings of herbaceous plants and trees are more attractive than solid plantings. Good plant cover requires maintenance, including fertilizer and reseeding and replanting spots where the vegetation failed to become established.

These soils have moderate to severe limitations for most urban uses. The soils above the flood plain and on gentle slopes are desirable as sites for buildings. The moderately slow permeability is a severe limitation for septic tank absorption fields. Rock fragments interfer with most uses. These soils are subject to subsidence, especially for the first few years after mining.

This map unit is in capability subclass VIs. Fairpoint soil is in woodland suitability group 3r; Bethesda and Morristown soils are in woodland suitability group 4r.

FrF—Frondorf-Wellston silt loams, 30 to 50 percent slopes. This map unit consists of Frondorf and Wellston soils in areas that are so intermingled that they could not be mapped separately. These soils are on hillsides throughout the survey area. Most areas contain both Frondorf and Wellston soils. Slopes are generally 200 to 600 feet long. Individual areas range from 5 to 50 acres.

Frondorf soil makes up about 45 percent of the map unit. Typically, the surface layer is very dark grayish brown silt loam 2 inches thick. The subsurface layer is brown silt loam to a depth of 5 inches. The subsoil extends to a depth of 30 inches. The upper part is strong brown silt loam, and the lower part is strong brown gravelly silt loam. The substratum, to a depth of 36 inches, is yellowish brown gravelly loam. Sandstone bedrock is at a depth of about 36 inches.

Wellston soil makes up about 25 percent of the map unit. Typically, the surface layer is dark grayish brown silt loam 2 inches thick. The subsurface layer is brown silt loam to a depth of 6 inches. The subsoil extends to a

depth of 45 inches. The upper part is brown silt loam, and the lower part is dark yellowish brown silt loam. The substratum, to a depth of 65 inches, is mottled yellowish brown and gray silt loam. Sandstone bedrock is at a depth of 65 inches.

Frondorf soil has a moderately deep root zone. The available water capacity is moderately high. Wellston soil has a deep root zone. The available water capacity is high. These soils have moderate permeability. They are low in organic matter content and medium in natural fertility. Except in areas where lime has been added, Frondorf soil is strongly acid or very strongly acid and Wellston soil is very strongly acid to medium acid. Surface runoff is rapid.

Included with these soils in mapping are soils that are shallow to bedrock and a few bedrock escarpments. Also included are soils that are similar to Frondorf soil except that they have more sand or more coarse fragments and areas of Frondorf soils that contain 5 to 10 percent stones on the surface. This map unit includes Zanesville soils on hilltops, Clifty and Steff soils along narrow draws, and Rosine soils on side slopes. The included soils make up about 30 percent of the map unit.

The soils of this map unit are poorly suited to cultivated crops, hay, or pasture because of the hazard of erosion, steep slopes, and bedrock escarpments. Some areas of these soils can be used for hay and pasture if a good plant cover is maintained. Good plant cover can be maintained by seeding on the contour, using lime and fertilizer, using proper seeding rates and mixtures, controlling weeds, and controlling grazing. Mowing and reseeding are difficult because of the steep slopes, and in places bedrock escarpments and rock fragments interfere with the use of equipment.

These soils are suited to woodland, and the potential productivity is high to moderately high. Preferred trees include yellow-poplar, black walnut, eastern white pine, white oak, northern red oak, shortleaf pine, and loblolly pine. Equipment limitations, the hazard of erosion, and plant competition are management concerns.

These soils are poorly suited to most urban uses because of the slope and depth to bedrock. Considerable grading and leveling is needed to reduce the slope. Bedrock, which is at a depth of 20 to 40 inches in the Frondorf soil and at a depth of 40 to 70 inches in the Wellston soil, limits the amount of grading and leveling that can be done. In most places, the bedrock can be excavated by heavy equipment. Erosion is a hazard during construction unless precautionary measures are taken.

This map unit is in capability subclass VIIe and in woodland suitability groups 2r (north slopes) and 3r (south slopes).

FsD2—Frondorf-Wellston-Rosine silt loams, 12 to 20 percent slopes, eroded. This map unit consists of Frondorf, Wellston, and Rosine soils in areas that are so intermingled that they could not be mapped separately. These soils are on hillsides throughout the survey area. Most mapped areas have all of these soils, but some areas have only one or two of these soils. Areas in the northern part of the survey area consist of a higher percentage of Wellston soil, and areas in the southern part consist of a higher percentage of Frondorf and Rosine soils. Slopes are generally 200 to 600 feet long. Individual areas range from 5 to 50 acres.

Frondorf soil makes up about 40 percent of the map unit. Typically, the surface layer is very dark grayish brown silt loam 2 inches thick. The subsurface layer is brown silt loam to a depth of 5 inches. The subsoil extends to a depth of 30 inches. The upper part is strong brown silt loam, and the lower part is strong brown gravelly silt loam. The substratum, to a depth of 36 inches, is yellowish brown gravelly loam. Sandstone bedrock is at a depth of about 36 inches.

Wellston soil makes up about 25 percent of the map unit. Typically, the surface layer is dark grayish brown silt loam 2 inches thick. The subsurface layer is brown silt loam to a depth of 6 inches. The subsoil extends to a depth of 45 inches. The upper part is brown silt loam, and the lower part is dark yellowish brown silt loam. The substratum, to a depth of 65 inches, is mottled yellowish brown and gray silt loam. Sandstone bedrock is at a depth of 65 inches.

Rosine soil makes up about 15 percent of the map unit. Typically, the surface layer is very dark grayish brown silt loam 1 inch thick. The subsurface layer is brown silt loam to a depth of 4 inches. The subsoil extends to a depth of 50 inches. The upper part is strong brown silty clay loam, and the lower part is mottled brown and gray silty clay. The substratum, to a depth of 60 inches, is gray and strong brown shaly silty clay loam. Shale and siltstone are at a depth of 60 inches.

Frondorf soil has a moderately deep root zone. The available water capacity is moderately high. Wellston and Rosine soils have a deep root zone, and the available water capacity is high. Frondorf and Wellston soils have moderate permeability, and Rosine soil has moderately slow permeability. These soils are low in organic matter content and medium in natural fertility. Except in areas where lime has been added, Frondorf and Rosine soils are strongly acid or very strongly acid and Wellston soil is very strongly acid to medium acid. Surface runoff is rapid.

Included with these soils in mapping are soils that are shallow to bedrock and soils that are similar to this Frondorf soil except that they have more sand or more coarse fragments throughout the profile. Also included are Frondorf soils that contain 5 to 10 percent stones on the surface, Zanesville soils on hilltops, Clifty and Steff soils along narrow draws, and Caneyville soils on side slopes. The included soils make up about 20 percent of the map unit.

Most areas of this map unit are in woodland or wild brushy vegetation. A few areas are in pasture or cultivated crops.

These soils are poorly suited to cultivated crops. If the soils are cultivated, erosion is a very severe hazard. Most of the cultivated crops that are grown in the survey area will grow on these soils. Crops respond to lime and fertilizer. The plow layer is easy to till and can be worked over a wide range of moisture content. Conservation tillage, contour cultivation, stripcropping, cover crops, addition of organic matter, grassed waterways, and grasses and legumes in the rotation system reduce runoff and help to control erosion.

These soils are suited to hay and pasture. They are suited to most grasses and legumes that are grown in the survey area. The main management needs are proper seeding mixtures and rates, use of lime and fertilizer, control of weeds, and control of grazing.

These soils are suited to woodland, and the potential productivity is high to moderately high. Eastern white pine, yellow-poplar, black walnut, white oak, northern red oak, shortleaf pine, white ash, and loblolly pine are preferred trees to plant. The hazard of erosion, equipment limitations, and plant competition are management concerns.

These soils are poorly suited to most urban uses because of the slope and depth to bedrock. Considerable grading and leveling is needed to reduce the slope. Bedrock, which is at a depth of 20 to 72 inches, reduces the amount of grading and leveling that can be done; however, in places the bedrock can be excavated by heavy equipment. Erosion is a hazard during construction unless precautionary measures are taken.

This map unit is in capability subclass IVe and in woodland suitability groups 2r (north slopes) and 3r (south slopes).

FsE—Frondorf-Wellston-Rosine silt loams, 20 to 30 percent slopes. This map unit consists of Frondorf, Wellston, and Rosine soils in areas that are so intermingled that they could not be mapped separately. These soils are on hillsides throughout the survey area. Most mapped areas have all of these soils, but some areas have only one or two of these soils. Areas in the northern part of the county consist of a higher percentage of Wellston soil, and areas in the southern part consist of a higher percentage of Frondorf and Rosine soils. Slopes are generally 200 to 600 feet long. Individual areas range from 5 to 50 acres.

Frondorf soil makes up about 40 percent of the map unit. Typically, the surface layer is very dark grayish brown silt loam 2 inches thick. The subsurface layer is brown silt loam to a depth of 5 inches. The subsoil extends to a depth of 30 inches. The upper part is strong brown silt loam, and the lower part is strong brown gravelly silt loam. The substratum, to a depth of 36 inches, is yellowish brown gravelly loam. Sandstone bedrock is at a depth of about 36 inches.

Wellston soil makes up about 25 percent of the map unit. Typically, the surface layer is dark grayish brown silt loam 2 inches thick. The subsurface layer is brown silt loam to a depth of 6 inches. The subsoil extends to a depth of 45 inches. The upper part is brown silt loam, and the lower part is dark yellowish brown silt loam. The substratum, to a depth of 65 inches, is mottled yellowish brown and gray silt loam. Sandstone bedrock is at a depth of 65 inches.

Rosine soil makes up about 15 percent of the map unit. Typically, the surface layer is very dark grayish brown silt loam 1 inch thick. The subsurface layer is brown silt loam to a depth of 4 inches. The subsoil extends to a depth of 50 inches. The upper part is strong brown silty clay loam, and the lower part is mottled brown and gray silty clay. The substratum, to a depth of 60 inches, is gray and strong brown shaly silty clay loam. Shale and siltstone are at a depth of 60 inches.

Frondorf soil has a moderately deep root zone. The available water capacity is moderately high. Wellston and Rosine soils have a deep root zone. The available water capacity is high. Frondorf and Wellston soils have moderate permeability, and Rosine soil has moderately slow permeability. These soils are low in organic matter content and medium in natural fertility. Except in areas where lime has been added, Frondorf and Rosine soils are strongly acid or very strongly acid and Wellston soil is very strongly acid to medium acid. Surface runoff is rapid.

Included with these soils in mapping are soils that are shallow to bedrock and soils that are similar to this Frondorf soil except that they have more sand or more coarse fragments. Also included are Frondorf soils that contain 5 to 10 percent stones on the surface, Zanesville soils on hilltops, Clifty and Steff soils along the draws, and Caneyville soils on side slopes. In places rock outcrops are included. The included soils make up about 20 percent of the map unit.

Most areas of this map unit are in woodland or wild brushy vegetation. A few areas are in pasture or cultivated crops.

Most of these soils are poorly suited to cultivated crops because of the hazard of erosion. They are suited to grasses and legumes for hay and pasture. Crops respond well to lime and fertilizer. Erosion control measures are needed during seedbed preparation and pasture renovation. Controlled grazing helps maintain good plant cover at all times. Other management needs include control of weeds and proper seeding rates and mixtures.

These soils are suited to woodland, and the potential productivity is high to moderately high. Eastern white pine, yellow-poplar, black walnut, white oak, northern red oak, shortleaf pine, loblolly pine, and white ash are

preferred trees to plant. The hazard of erosion, equipment limitations, and plant competition are management concerns.

These soils are poorly suited to most urban uses because of the slope and depth to bedrock. Considerable grading and leveling is needed to reduce the slope. Bedrock, which is at a depth of 20 to 72 inches, reduces the amount of grading and leveling that can be done; however, in places the bedrock can be excavated by heavy equipment. Erosion is a hazard during construction unless precautionary measures are taken.

This map unit is in capability subclass VIe and in woodland suitability groups 2r (north slopes) and 3r (south slopes).

FwD3—Frondorf-Wellston-Rosine complex, 12 to 20 percent slopes, severely eroded. This map unit consists of Frondorf, Wellston, and Rosine soils in areas that are so intermingled that they could not be mapped separately. These soils are on hillsides throughout the survey area. Most mapped areas contain all of these soils, but some areas have only one or two of these soils. In more than 30 percent of the mapped area, the original surface layer has been removed by erosion, and, in places, part of the subsoil has been removed. Slopes are generally 200 to 600 feet long. Individual areas range from 5 to 50 acres.

Frondorf soil makes up about 40 percent of the map unit. Typically, the surface layer is brown silt loam 8 inches thick. The subsoil extends to a depth of 20 inches. The upper part is strong brown silt loam, and the lower part is strong brown gravelly silt loam. The substratum, to a depth of 26 inches, is yellowish brown gravelly loam. Sandstone bedrock is at a depth of about 26 inches.

Wellston soil makes up about 20 percent of the map unit. Typically, the surface layer is brown silt loam 8 inches thick. The subsoil extends to a depth of 35 inches. The upper part is brown silt loam, and the lower part is dark yellowish brown silt loam. The substratum, to a depth of 55 inches, is mottled yellowish brown and gray silt loam. Sandstone bedrock is at a depth of 55 inches.

Rosine soil makes up about 20 percent of the map unit. Typically, the surface layer is strong brown silty clay loam about 8 inches thick. The subsoil extends to a depth of 40 inches. The upper part is strong brown silty clay loam, and the lower part is mottled brown and gray silty clay. The substratum, to a depth of 50 inches, is gray and strong brown shaly silty clay loam. Shale and siltstone are at a depth of 50 inches.

Frondorf soil has a moderately deep root zone. The available water capacity is moderately high. Wellston and Rosine soils have a deep root zone. The available water capacity is high. Frondorf and Wellston soils have moderate permeability, and Rosine soil has moderately slow permeability. These soils are very low in organic matter content and low in natural fertility. Except in areas where lime has been added, Frondorf and Rosine soils are strongly acid or very strongly acid and Wellston soil is very strongly acid to medium acid. Surface runoff is rapid.

Included with these soils in mapping are soils that are shallow to bedrock and some gullied areas that are eroded to bedrock. A few rock outcrops are in some places. Also included are soils that are similar to this Frondorf soil except that they have more sand or more coarse fragments throughout the profile, Frondorf soils that contain 5 to 10 percent stones on the surface, Zanesville soils on hilltops, Clifty and Steff soils along draws, and Caneyville soils on side slopes. The included soils make up about 20 percent of the map unit.

Most areas of this map unit have been used for row crops but are now in trees or brushy vegetation. A few areas are in pasture or row crops.

Most of these soils are poorly suited to cultivated crops because of the hazard of erosion. They are suited to grasses and legumes for hay and pasture. Crops respond well to lime and fertilizer. Erosion control measures are needed during seedbed preparation and pasture renovation. Controlled grazing helps maintain good plant cover at all times. Other management needs include control of weeds and proper seeding rates and mixtures.

These soils are suited to woodland, and potential productivity is high or moderately high. Eastern white pine, shortleaf pine, loblolly pine, white oak, northern red oak, and white ash are preferred trees to plant on cool slopes. Shortleaf pine, loblolly pine, and Virginia pine are preferred on warm slopes. The hazard of erosion, equipment limitations, and plant competition are management concerns.

These soils are poorly suited to most urban uses because of the slope and depth to bedrock. For most urban uses, considerable grading and leveling is needed to reduce the slope. Bedrock, which is at a depth of 20 to 40 inches in Frondorf soil and 40 to 70 inches in Wellston and Rosine soils, limits the amount of grading and leveling that can be done. In many places, the bedrock can be excavated by heavy equipment. Erosion is a hazard during construction unless precautionary measures are taken.

This map unit is in capability subclass VIe and in woodland suitability groups 3r (north slopes) and 4r (south slopes).

FwE3—Frondorf-Wellston-Rosine complex, 20 to 30 percent slopes, severely eroded. This map unit consists of Frondorf, Wellston, and Rosine soils in areas that are so intermingled that they could not be mapped separately. These soils are on hillsides throughout the survey area. Most mapped areas contain all of these soils, but some areas have only one or two of these

soils. In more than 30 percent of the area, the original surface layer has been removed by erosion, and, in places, part of the subsoil has been removed. Slopes are generally 200 to 600 feet long. Individual areas range from 5 to 50 acres.

Frondorf soil makes up about 40 percent of the map unit. Typically, the surface layer is brown silt loam 8 inches thick. The subsoil extends to a depth of 20 inches. The upper part is strong brown silt loam, and the lower part is strong brown gravelly silt loam. The substratum, to a depth of 26 inches, is yellowish brown gravelly loam. Sandstone bedrock is at a depth of about 26 inches.

Wellston soil makes up about 20 percent of the map unit. Typically, the surface layer is brown silt loam 8 inches thick. The subsoil extends to a depth of 35 inches. The upper part is brown silt loam, and the lower part is dark yellowish brown silt loam. The substratum, to a depth of 55 inches, is mottled yellowish brown and gray silt loam. Sandstone bedrock is at a depth of 55 inches.

Rosine soil makes up about 20 percent of the map unit. Typically, the surface layer is strong brown silty clay loam about 8 inches thick. The subsoil extends to a depth of 40 inches. The upper part is strong brown silty clay loam, and the lower part is mottled brown and gray silty clay. The substratum, to a depth of 50 inches, is gray and strong brown shaly silty clay loam. Shale and siltstone are at a depth of 50 inches.

Frondorf soil has a moderately deep root zone. The available water capacity is moderately high. Wellston and Rosine soils have a deep root zone. The available water capacity is high. Frondorf and Wellston soils have moderate permeability, and Rosine soil has moderately slow permeability. These soils are very low in organic matter content and low in natural fertility. Except in areas where lime has been added, Frondorf and Rosine soils are strongly acid or very strongly acid and Wellston soil is very strongly acid to medium acid. Surface runoff is rapid.

Included with these soils in mapping are soils that are shallow to bedrock and some gullied areas that are eroded to bedrock. A few rock outcrops are in some places. Also included are soils that are similar to this Frondorf soil except that they have more sand or more coarse fragments throughout the profile, Frondorf soils that contain 5 to 10 percent stones on the surface, Zanesville soils on hilltops, Clifty and Steff soils along the draws, and Caneyville soils on side slopes. The included soils make up about 20 percent of the map unit.

Most areas of this map unit have been used for row crops but are now in trees or brushy vegetation. A few areas are in pasture.

Most of these soils are poorly suited to cultivated crops because of the hazard of erosion. They are suited to grasses and legumes for hay and pasture. Crops respond well to lime and fertilizer. Erosion control measures are needed during seedbed preparation and pasture renovation. Controlled grazing helps maintain good plant cover at all times. Other management needs include control of weeds and proper seeding rates and mixtures.

These soils are suited to woodland, and the potential productivity is high or moderately high. Eastern white pine, shortleaf pine, loblolly pine, white oak, northern red oak, and white ash are preferred trees to plant on cool slopes. Shortleaf pine, loblolly pine, and Virginia pine are preferred on warm slopes. The hazard of erosion, equipment limitations, and plant competition are management concerns.

These soils are poorly suited to most urban uses because of the slope and depth to bedrock. Considerable grading and leveling is needed to reduce the slope. Bedrock, which is at a depth of 20 to 40 inches in Frondorf soil and at a depth of 40 to 70 inches in Wellston and Rosine soils, limits the amount of grading and leveling that can be done. In many places, the bedrock can be excavated by heavy equipment. Erosion is a hazard during construction unless precautionary measures are taken.

Wellston soil is in capability subclass VIe, and Frondorf and Rosine soils are in capability subclass VIIe. This map unit is in woodland suitability groups 3r (north slopes) and 4r (south slopes).

He—Henshaw silt loam. This deep, nearly level, somewhat poorly drained soil is on stream terraces along the Rough River. Slopes are mostly 0 to 2 percent but range up to 4 percent. Most areas of this soil are slightly higher than adjacent soils and are subject to flooding. Individual areas are 5 to 50 acres.

Typically, the surface layer is brown silt loam 9 inches thick. The subsoil is mottled in shades of gray and brown to a depth of 40 inches. The upper part of the subsoil is silt loam, and the lower part is silty clay loam. The substratum to a depth of 60 inches or more is mottled yellowish brown, strong brown, and light gray silt loam.

This soil has moderately slow permeability. Runoff is slow. The root zone is deep. The available water capacity is high. This soil is low in content of organic matter and medium in natural fertility. The surface layer is strongly acid or medium acid except in areas that have been limed. Some areas of this soil are above flood level, but most areas are flooded at rare intervals.

Included with this soil in mapping are a few areas of McGary, Stendal, and Weinbach soils. Also included are soils that are silty clay in the substratum, soils that are medium or strongly acid in the substratum, and soils that are grayer and wetter than Henshaw soil. The included soils make up 15 to 25 percent of the map unit.

Most of this Henshaw soil is used for corn and soybeans.

This soil is well suited to cultivated crops. The erosion hazard is slight, and this soil can be intensively cultivated

without significant loss of soil. The plow layer is easy to till and can be worked over a wide range of moisture content. Most crops that are grown in the survey area will grow on this soil; however, drainage significantly improves the suitability for some crops. Important management practices include cover crops, lime and fertilizer, and return of crop residue.

This soil is well suited to hay and pasture. It is suited to grasses and legumes that do not require a well drained soil. Drainage improves the suitability for some crops. The main management needs are proper seeding rates and mixtures, lime and fertilizer, control of weeds, and control of grazing.

This soil is well suited to woodland, and the potential productivity is very high. The equipment limitation is moderate because of wetness. The competition from undesirable plants is severe. Preferred trees include green ash, sweetgum, eastern cottonwood, and yellow-poplar.

This soil is poorly suited to some urban uses because of the seasonal high water table, moderately slow permeability, and the hazard of flooding.

This Henshaw soil is in capability subclass IIw and in woodland suitability group 1w.

HoB2—Hosmer silt loam, 2 to 6 percent slopes, eroded. This deep, gently sloping, moderately well drained soil is mostly on hilltops in the northwestern part of the county. Most mapped areas are narrow and winding. They range from about 200 to 500 feet wide and contain from 5 to 25 acres. Slopes are mostly convex and 100 to 300 feet long.

Typically, the surface layer is brown silt loam about 8 inches thick. The subsoil, to a depth of 30 inches, is brown or strong brown silty clay loam or silt loam. To a depth of 70 inches, it is a strong brown or brown silt loam fragipan that has mottles in shades of gray and brown.

This soil has moderate permeability above the fragipan and slow permeability in the fragipan. Runoff is medium. This soil has a moderately deep root zone to the fragipan. The available water capacity is moderate. This soil is low in content of organic matter and medium in natural fertility. It is medium acid to very strongly acid except in areas that have been limed.

Included with this soil in mapping are small areas of Zanesville soils. Also included are Hosmer soils that are severely eroded, have a silty clay loam surface layer, and have a fragipan at a depth of about 20 inches. Soils that have 6 to 10 percent slopes are included in some areas. The included soils make up about 15 to 25 percent of the map unit.

This Hosmer soil is used for corn, tobacco, soybeans, hay, and pasture. Many farm buildings have been constructed in areas of this soil. Small areas are in woodland.

This soil is well suited to cultivated crops; however, erosion is a moderate hazard. This soil is suited to most of the cultivated crops that are grown in the survey area. Crops respond to lime and fertilizer. The plow layer is easy to till and can be worked over a wide range of moisture content. Conservation tillage, contour cultivation, stripcropping, cover crops, addition of organic matter, grassed waterways, and grasses and legumes in the rotation system reduce runoff and help to control erosion.

This soil is well suited to hay and pasture. It is suited to most of the grasses and legumes that are grown in the survey area; however, some deep-rooted crops are short-lived. The main management needs are proper seeding rates and mixtures, lime and fertilizer, control of weeds, and control of grazing.

This soil is well suited to trees, and the potential productivity is high. Most trees that grow on uplands in the area grow well on this soil. A few small areas remain in native hardwoods. Preferred trees include eastern white pine, shortleaf pine, yellow-poplar, and white ash.

This soil is well suited to most urban uses. Because this soil is on uplands, it is desirable as sites for buildings. This soil has a severe limitation for sanitary facilities because of the slow permeability of the fragipan, but this limitation can be overcome by enlarging the absorption area or modifying the filter field.

This Hosmer soil is in capability subclass IIe and in woodland suitability group 2o.

Ka—Karnak silt loam, overwash, occasionally flooded. This deep, nearly level, poorly drained soil is in wide valleys near the Rough River in the western part of the county. Slopes are mostly 0 to 2 percent. Individual areas range from 10 to 50 acres.

Typically, the surface layer is brown silt loam about 10 inches thick. The subsoil, to a depth of 50 inches, is light gray silty clay or clay that has strong brown or yellowish brown mottles. The substratum to a depth of 70 inches or more is mottled gray, yellowish brown, and light olive brown clay.

This soil has very slow permeability. Runoff is slow. The available water capacity is high. The root zone is deep, except when it is limited by the seasonal high water table. The content of organic matter is low. This soil is high in natural fertility. Reaction is medium acid to neutral except in areas that have been limed. This soil has a seasonal high water table and is subject to occasional flooding.

Included with this soil in mapping are a few areas of soils that have 15 to 20 inches of silt loam overwash, and a few areas of soils that have very dark gray horizons below the overwash. McGary and Melvin soils are also included. The included soils make up about 15 to 25 percent of the map unit.

Most of this Karnak soil is used for corn and soybeans.

If this soil is adequately drained, it is suited to most row crops grown in the survey area. This soil is not subject to erosion and can be cultivated intensively without loss of soil. Flooding generally occurs in winter or spring when row crops are not growing. Tilth is good, and this soil can be worked over a wide range of moisture content. Important management practices include cover crops, lime and fertilizer, and return of crop residue.

This soil is suited to hay and pasture. It is suited to grasses and legumes that do not require a well drained soil. Drainage to lower the seasonal high water table improves the suitability for most plants. In places, grasses and legumes are damaged by flooding. Management needs include selection of suitable plants, proper seeding, lime and fertilizer, control of weeds, and control of grazing.

This soil is well suited to woodland, and the potential productivity is high. Limitations are severe for the use of equipment. Seedling mortality and plant competition are management concerns. Preferred trees include pin oak, swamp white oak, green ash, baldcypress, and sweetgum.

The soil is poorly suited to most urban uses because of the seasonal high water table and the hazard of flooding. It also has limitations for some uses because of the high clay content of the subsoil and the high shrink-swell potential. Low strength is a limitation for local roads and streets.

This Karnak soil is in capability subclass IIIw and in woodland suitability group 2w.

Kc—Karnak silty clay, occasionally flooded. This deep, nearly level, poorly drained soil is in wide, level areas near the Rough River in the western part of the county. Slopes are mostly 0 to 2 percent. Most areas of this soil are occasionally flooded by the Rough River. Individual areas range from 20 to 100 acres.

Typically, the surface layer is dark grayish brown silty clay about 8 inches thick. The subsoil, to a depth of 40 inches, is light gray silty clay and clay that has strong brown or yellowish brown mottles. The substratum to a depth of 60 inches or more is mottled gray, yellowish brown, and light olive brown clay.

This soil has slow permeability. Runoff is slow. The available water capacity is high. The root zone is deep except when it is limited by the water table. The organic matter content is low. This soil is high in natural fertility. The plow layer is medium acid to neutral except in areas that have been limed. This soil has a seasonal high water table and is subject to occasional flooding.

Included with this soil in mapping are Karnak soils that have silty clay loam or clay in the surface layer and soils that are darker in the surface layer than this Karnak soil. Also included are small areas of McGary and Melvin soils. The included soils make up about 15 to 20 percent of the map unit.

Most of this soil is used for corn and soybeans.

If this soil is adequately drained, it is suited to most row crops grown in the survey area. This soil is not subject to erosion and can be cultivated intensively without loss of soil. Flooding generally occurs in winter or spring when row crops are not growing. Crops respond to fertilizer, but most areas do not need lime. The plow layer is sticky and plastic when wet and hard and cloddy when dry. Important management practices include use of cover crops and return of crop residue.

This soil is suited to hay and pasture. It is suited to grasses and legumes that do not require a well drained soil. Drainage to lower the water table improves the suitability for plants. In places, grasses and legumes are damaged by flooding. Management needs include selection of suitable plants, proper seeding, fertilizer, control of weeds, and control of grazing.

This soil is well suited to woodland, and the potential productivity is high. The use of equipment is severely limited. Seedling mortality and plant competition are management concerns. Preferred trees include pin oak, swamp white oak, green ash, baldcypress, and sweetgum.

This soil is poorly suited to most urban uses because of the seasonal high water table and the hazard of flooding. It also has limitations for some uses because of the high clay content, which causes the soil to be hard to work, and the high shrink-swell potential. Low strength is a limitation for local roads and streets.

This Karnak soil is in capability subclass IIIw and in woodland suitability group 2w.

Ld—Lindside silt loam, occasionally flooded. This deep, nearly level, moderately well drained soil formed in alluvium on flood plains. Slopes are 0 to 2 percent. Most of this soil is near the Green River or the Rough River adjacent to outcrops of limestone. Most mapped areas are about 10 to 40 acres.

Typically, the surface layer is dark brown silt loam about 8 inches thick. The subsoil, to a depth of 20 inches, is brown silt loam. To a depth of 30 inches, it is brown silt loam that has dark brown and grayish brown mottles. The substratum to a depth of 60 inches or more is grayish brown silt loam that has brown and dark brown mottles.

This soil has moderate permeability. Runoff is slow. The available water capacity is high, and the root zone is deep. The content of organic matter is low. This soil is medium in natural fertility, and it is strongly acid to slightly acid. It has a seasonal high water table and is subject to occasional flooding.

Included with this soil in mapping are areas of Elk, Newark, Nolin, Otwell, and Steff soils. Also included are soils that contain more sand in the subsoil than Lindside soil, soils that are neutral in the subsoil, and soils that are more acid in the subsoil than Lindside soil. The

included soils make up about 20 to 30 percent of the map unit.

Most of this Lindside soil is used for corn and soybeans. A few areas are in pasture or woodland.

This soil is well suited to cultivated crops. It is not subject to erosion and can be cultivated intensively without loss of soil. Most flooding occurs in winter or spring when row crops are not growing. Crops respond to fertilizer. Drainage improves the suitability for some crops. The plow layer is easy to till and can be worked over a wide range of moisture content. Cover crops and return of crop residue increase the content of organic matter and improve tilth.

This soil is well suited to hay and pasture. It is suited to most grasses and legumes that are grown in the survey area. Management needs include suitable plants, proper seeding, fertilizer, control of weeds, and control of grazing.

This soil is well suited to woodland, and the potential productivity is very high. Preferred trees include eastern white pine, yellow-poplar, white oak, black walnut, northern red oak, and white ash. There is competition from undesirable trees, shrubs, and vines. Most harvesting is done in summer and fall because the soil is wet in winter.

This soil is poorly suited to most urban uses because of the hazard of flooding and the seasonal high water table. In most years, this soil is flooded in winter and spring. Permanent structures can be protected from flooding by dikes and levees. Generally the lower part of the subsoil is saturated with water for several weeks in winter. Surplus water can be removed by ditches and tile drains.

This Lindside soil is in capability subclass IIw and in woodland suitability group 1o.

Mc—McGary silt loam. This deep, somewhat poorly drained, nearly level soil is on wide, flat stream terraces along the Green River and the Rough River. Slopes are mostly 0 to 2 percent but range up to 5 percent. Most areas of this soil are a few feet higher than adjacent soils on flood plains.

Typically, the surface layer is brown silt loam about 9 inches thick. The subsoil, to a depth of 20 inches, is mottled light brownish gray and yellowish brown silty clay loam. To a depth of 50 inches, it is yellowish brown silty clay that has grayish brown and light brownish gray mottles. The substratum to a depth of 60 inches or more is mottled yellowish brown and light brownish gray silty clay.

This soil has slow permeability. Runoff is slow. The root zone is deep, and the available water capacity is high. The content of organic matter is low, and the natural fertility is medium. This soil is medium acid or strongly acid in the surface layer except in areas that have been limed. Most of this soil is rarely flooded.

Included with this soil in mapping are small areas of Henshaw and Newark soils and a few areas of McGary silty clay loam. Also included are soils that have more slope than McGary soil, soils that have a clay subsoil, and soils that are acid in the substratum. The included soils make up about 20 to 30 percent of this map unit.

Most of this McGary soil is used for corn and soybeans; some areas are in hay, pasture, or woodland.

This soil is suited to cultivated crops. The erosion hazard is slight, and this soil can be intensively cultivated without significant loss of soil. The plow layer is easy to till and can be worked over a wide range of moisture content. Most crops that are grown in the survey area, except crops that require a well drained soil, will grow on this soil. Important management practices include cover crops, lime and fertilizer, return of crop residue, and removal of excess surface water.

This soil is suited to hay and pasture. It is suited to grasses and legumes that do not require a well drained soil. Surface drainage improves the suitability for some plants. The main management needs are proper seeding rates and mixtures, lime and fertilizer, control of weeds, and control of grazing.

This soil is suited to woodland, and the potential productivity is high. Equipment limitations and plant competition are management concerns. Preferred trees include eastern white pine, loblolly pine, and American sycamore.

This soil is poorly suited to urban uses because of the seasonal high water table, the hazard of flooding, and the clayey texture of the subsoil. The subsoil is generally saturated with water for several weeks in winter, and the slow permeability of the subsoil reduces the effectiveness of tile drains. The slow permeability and high water table are severe limitations for sanitary facilities. The clayey subsoil is difficult to grade, excavate, or compact, and it has high shrink-swell potential. Low strength is a limitation for use as foundation material for roads.

This McGary soil is in capability subclass IIIw and in woodland suitability group 2w.

Me—Melvin silt loam, occasionally flooded. This deep, nearly level, poorly drained soil is in narrow valleys below outcrops of limestone and in wide, flat areas that are flooded by the Rough River and the Green River. Slopes are 0 to 2 percent. Individual areas are 5 to 100 acres.

Typically, the surface layer is grayish brown silt loam about 6 inches thick. The subsoil, to a depth of about 40 inches, is light gray and gray silt loam that has yellowish brown mottles. The substratum to a depth of 65 inches or more is gray silty clay loam that has yellowish brown mottles.

This soil has moderate permeability. Runoff is slow. The root zone is deep. The available water capacity is high. The content of organic matter is low, and the

natural fertility is medium. The surface layer is medium acid to mildly alkaline. This soil has a seasonal high water table and is subject to occasional flooding.

Included with this soil in mapping are small areas of Bonnie and Newark soils. Also included are soils that are medium acid or very strongly acid in the surface layer and subsoil and soils that are silty clay below a depth of 40 inches. The included soils make up about 15 to 25 percent of the map unit.

Most of this Melvin soil is used for corn and soybeans. A few areas are in hay or woodland.

If this soil is adequately drained, it is suited to most row crops grown in the survey area. The erosion hazard is slight, and this soil can be cultivated intensively without loss of soil. Flooding generally occurs in winter or spring when crops are not growing. Crops respond to fertilizer, but most of the commonly grown crops do not respond to lime. Important management practices include cover crops and return of crop residue.

This soil is well suited to hay and pasture. It is suited to grasses and legumes that do not require a well drained soil. Drainage to lower the water table improves the suitability for most plants. In places, grasses and legumes are damaged by flooding. Management needs include selection of suitable plants, proper seeding, fertilizer, control of weeds, and control of grazing.

This soil is well suited to woodland, and the potential productivity is very high. Most trees that grow on wet soils are suited to this soil. Preferred trees include pin oak, American sycamore, sweetgum, loblolly pine, green ash, and eastern cottonwood. Undesirable trees, vines, and shrubs can be controlled by site preparation, cutting, spraying, or girdling. Seedlings have a moderate survival rate. Most harvesting is done in summer or fall because the use of equipment is limited in wet seasons.

This soil is poorly suited to urban uses because of the hazard of flooding and the seasonal high water table. Most of this soil is flooded in winter; however, in most places urban improvements can be protected by dikes and levees. Generally this soil is saturated for several weeks in winter. The surplus water can be removed by drainage, but for some uses this is not practical.

This Melvin soil is in capability subclass IIIw and in woodland suitability group 1w.

Ne—Newark silt loam, occasionally flooded. This deep, nearly level, somewhat poorly drained soil formed in alluvium in the Green River Valley and the Rough River Valley. Slopes are 0 to 2 percent. This soil is in wide, flat areas that are flooded by the Green River and in narrow valleys below outcrops of limestone.

Typically, the surface layer is brown silt loam 8 inches thick. The subsoil, to a depth of 14 inches, is dark yellowish brown silt loam and, to a depth of 42 inches, is gray silt loam that has yellowish brown mottles. The substratum to a depth of 66 inches or more is mottled gray and dark yellowish brown silt loam.

This soil has moderate permeability. Runoff is slow. The available water capacity is high, and the root zone is deep. The content of organic matter is low to moderate. This soil is medium to high in natural fertility, and it is medium acid to neutral. It has a seasonal high water table and is subject to occasional flooding.

Included with this soil in mapping are small areas of Lindside and Melvin soils. Also included are soils that are strongly acid in some horizons and soils that are silty clay loam in the surface layer and subsoil. The included soils make up about 20 to 30 percent of the map unit.

Most of this Newark soil is used for corn and soybeans. A few areas are in hay, pasture, or woodland.

This soil is well suited to cultivated crops. It is not subject to erosion and can be cultivated intensively without loss of soil. Flooding generally occurs in winter or spring when row crops are not growing. Crops respond to fertilizer. Drainage improves the suitability for most crops. The plow layer is easy to till and can be worked over a wide range of moisture content. Cover crops and return of crop residue increase the content of organic matter and improve tilth.

This soil is well suited to hay and pasture. It is suited to most grasses and legumes that are grown in the survey area. Management needs include use of suitable plants, proper seeding, fertilizer, control of weeds, and control of grazing. In the winter, floods damage grasses and legumes in places.

This soil is well suited to woodland, and the potential productivity is very high. Most trees that grow on lowlands in the area are well suited to this soil. Preferred trees include eastern cottonwood, sweetgum, loblolly pine, American sycamore, and eastern white pine. Most harvesting is done in summer and fall because the soil is wet in winter.

This soil is poorly suited to most urban uses because of the hazard of flooding and the seasonal high water table. Permanent structures can be protected from flooding by dikes and levees. Generally the subsoil is saturated for several weeks in winter. Surplus water can be removed by ditches and tile drains.

This Newark soil is in capability subclass IIw and in woodland suitability group 1w.

No—Nolin silt loam, occasionally flooded. This deep, well drained, nearly level soil formed in alluvium along the larger streams in the survey area. In most places, this soil is adjacent to the streams. Individual areas range from 5 to 50 acres.

Typically, the surface layer is dark grayish brown silt loam about 9 inches thick. The subsoil extends to a depth of 48 inches. The upper part is dark brown silt loam, and the lower part is dark yellowish brown silt loam that has pale brown mottles. The substratum to a depth of 65 inches is dark yellowish brown silt loam that has pale brown mottles.

This soil has moderate permeability. Runoff is slow. The available water capacity is high, and the root zone is deep. The content of organic matter is low. This soil is medium to high in natural fertility, and it is medium acid to neutral. It is subject to occasional flooding.

Included with this soil in mapping are a few areas of soils that are dark brown in the surface layer. A few small, very steep areas of soils along the banks of streams are included. Also included are soils that are loam or fine sandy loam throughout and soils that are strongly acid in some horizons. This map unit includes a few areas of Lindside and Newark soils. The included soils make up about 15 to 25 percent of the map unit.

Most of this Nolin soil is used for corn and soybeans. A few areas are used for hay. A few areas along sloughs and on the banks of streams are in woodland.

This soil is well suited to cultivated crops. It is not subject to erosion and can be cultivated intensively without loss of soil. Flooding generally occurs in winter or spring when row crops are not growing. Crops respond to fertilizer. The plow layer is easy to till and can be worked over a wide range of moisture content. Cover crops and return of crop residue increase the content of organic matter and improve tilth.

This soil is well suited to hay and pasture. It is suited to most grasses and legumes that are grown in the survey area. In some years, perennials are damaged by winter floods. Management needs include proper seeding rates and mixtures, fertilizer, control of weeds, and control of grazing.

This soil is well suited to woodland, and the potential productivity is very high. Preferred trees include yellow-poplar, eastern white pine, cherrybark oak, eastern cottonwood, white ash, black walnut, and sweetgum. Tree seeds and seedlings survive and grow well if competing vegetation is controlled or removed.

This soil is poorly suited to most urban uses because of the hazard of flooding. In some places, urban structures can be protected from flooding by dikes and levees.

This Nolin soil is in capability subclass IIw and in woodland suitability group 1o.

OtA—Otwell silt loam, 0 to 2 percent slopes. This deep, nearly level, moderately well drained soil is mostly on low, long ridges that are parallel to the Green River and the Rough River. Many areas of this soil are about 300 to 500 feet wide and 2,000 to 6,000 feet long.

Typically, the surface layer of this soil is brown silt loam about 8 inches thick. The subsoil, to a depth of 24 inches, is yellowish brown silt loam. To a depth of 40 inches, it is a mottled dark yellowish brown, strong brown, and light gray silt loam fragipan. The substratum is yellowish brown, mottled silt loam to a depth of 60 inches or more.

This soil has moderate permeability above the fragipan and slow permeability in the fragipan. Runoff is slow. The root zone is moderately deep to the fragipan. The available water capacity is moderate. The organic matter content is low to moderate. This soil is medium in natural fertility. It is strongly acid or very strongly acid except in areas that have been limed. Some areas of this soil are above flood level, but most areas are subject to rare flooding.

Included with this soil in mapping are small areas of Elk, Newark, and Weinbach soils. Also included are soils that have a weakly developed fragipan. The included soils make up about 20 to 25 percent of the map unit.

Most of this Otwell soil is used for corn and soybeans. A few areas are in hay, pasture, or woodland.

This soil is suited to cultivated crops. The erosion hazard is slight, and this soil can be cultivated intensively without significant loss of soil. Crops respond to lime and fertilizer. The plow layer is easy to till and can be worked over a wide range of moisture content. Cover crops and return of crop residue increase the content of organic matter and improve the tilth.

This soil is well suited to hay and pasture. It is suited to most of the grasses and legumes that are grown in the survey area, but some deep-rooted crops are short-lived. Also, in some places perennials are damaged by floods. The main management needs are proper seeding rates and mixtures, lime and fertilizer, control of weeds, and control of grazing.

This soil is well suited to woodland, and the potential productivity is moderately high. Preferred trees include eastern white pine, loblolly pine, white ash, and white oak. Plant competition is the main concern in managing woodland.

This soil is poorly suited to most urban uses because of the hazard of flooding. Floods are rare, but they last for several days. Permanent urban structures can be protected from flooding by dikes and levees. The slow permeability of the fragipan is a severe limitation for septic tank filter fields, but this can be overcome by enlarging the absorption area or modifying the filter field.

This Otwell soil is in capability subclass IIw and in woodland suitability group 3o.

OtB2—Otwell silt loam, 2 to 6 percent slopes, eroded. This deep, gently sloping, moderately well drained soil is mostly on long, narrow, convex ridges parallel to the Green River and the Rough River. Slopes are 100 to 300 feet long. Ridges are about 300 to 600 feet wide and 1,000 to 2,000 feet long.

Typically, the surface layer of this soil is brown silt loam about 8 inches thick. The subsoil, to a depth of 24 inches, is yellowish brown silt loam. To a depth of 40 inches, it is a mottled dark yellowish brown, strong brown, and light gray silt loam fragipan. The substratum is yellowish brown, mottled silt loam to a depth of 60 inches or more.

This soil has moderate permeability above the fragipan and slow permeability in the fragipan. Runoff is medium.

The root zone is moderately deep to the fragipan. The available water capacity is moderate, and the organic matter content is low to moderate. This soil is medium in natural fertility. It is strongly acid or very strongly acid except in areas that have been limed. Most areas of this soil are rarely flooded.

Included with this soil in mapping are a few small areas of Elk, Newark, and Weinbach soils. Also included are a few areas of soils that have a weakly developed fragipan. The included soils make up about 20 to 30 percent of the map unit.

Most of this Otwell soil is used for corn and soybeans. A few areas are in hay, pasture, or woodland.

This soil is suited to cultivated crops. If this soil is cultivated, erosion is a moderate hazard. Crops respond to lime and fertilizer. The plow layer is easy to till and can be worked over a wide range of moisture content. Conservation tillage, contour cultivation, stripcropping, cover crops, addition of organic matter, grassed waterways, and grasses and legumes in the rotation system reduce runoff and help to control erosion.

This soil is well suited to hay and pasture. It is suited to most of the grasses and legumes that are grown in the survey area, but some deep-rooted crops are short-lived. Some perennials are damaged by floods. The main management needs are the proper seeding rates and mixtures, lime and fertilizer, control of weeds, and control of grazing.

This soil is well suited to woodland, and the potential productivity is moderately high. Preferred trees include eastern white pine, loblolly pine, white ash, and white oak. Plant competition is the main concern in managing woodland.

This soil is poorly suited to most urban uses because of the hazard of flooding. Floods are rare, but they last for several days. Permanent urban structures can be protected from flooding by dikes and levees. The slow permeability of the fragipan is a severe limitation for septic tank filter fields, but this can be overcome by enlarging the absorption area or modifying the filter field.

This Otwell soil is in capability subclass IIe and in woodland suitability group 3o.

Pi—Pits, quarry. This map unit consists of areas where limestone bedrock has been quarried. The soil and several feet of bedrock have been removed. A pit that has bedrock at the bottom remains. Pits generally have vertical walls around most of the mined area.

Included in mapping are mounds of soil and broken pieces of bedrock and a few mounds of limestone that have been graded into sizes for riprap, road material, or agricultural use. The mounds of soil and pieces of bedrock contain mostly soil in some places and mostly bedrock in other places. The pieces of bedrock are sandstone, shale, and limestone and range from about 1 inch to 3 feet in diameter. In most places in this map unit, little or no vegetation is growing.

Two quarries between Hartford and Dundee, a large quarry near Olaton, and a few small quarries are included in this map unit. These quarries are in the Rough Creek Fault Zone.

This map unit is in capability subclass VIIs. It is not assigned to a woodland suitability group.

Po—Pope fine sandy loam, occasionally flooded. This deep, nearly level, well drained soil is on flood plains. Slopes are 0 to 3 percent. This soil formed in alluvium that washed from adjacent uplands. It is at the base of hills, in narrow strips along large streams, or in narrow valleys in hilly areas. Most areas of this soil are 200 to 400 feet wide, 500 to 2,000 feet long, and contain about 10 to 30 acres.

Typically, the surface layer of this soil is brown fine sandy loam about 8 inches thick. The subsoil, to a depth of 30 inches, is dark yellowish brown and yellowish brown fine sandy loam. The substratum is pale brown and dark yellowish brown, mottled loamy fine sand and fine sandy loam to a depth of 70 inches or more.

This soil has moderate or moderately rapid permeability. Runoff is slow. The root zone is deep, and the available water capacity is high. This soil is low in organic matter content and medium in natural fertility. It is strongly acid or very strongly acid except in areas that have been limed. It is subject to occasional flooding.

Included with this soil in mapping are a few areas of Clifty, Cuba, Steff, and Stendal soils. Also included are small areas of soils that contain more sand throughout the profile, that contain less sand in the surface layer, or that contain more clay in the subsoil than Pope soil. Soils that are stratified and soils that contain up to 15 percent coarse fragments are also included. The included soils make up about 15 to 25 percent of the map unit.

Most of this Pope soil is used for corn, soybeans, and hay. A few areas in narrow valleys are in woodland.

This soil is well suited to cultivated crops. The erosion hazard is slight, and this soil can be cultivated in short rotations without loss of soil. Generally flooding occurs in winter or spring when row crops are not growing and is of short duration. Most crops respond to lime and fertilizer. The plow layer is easy to till and can be worked over a wide range of moisture content. Cover crops and the return of crop residue increase the content of organic matter and improve the tilth.

This soil is well suited to hay and pasture. It is suited to most grasses and legumes that are grown in the survey area; however, in some years perennials are damaged by winter floods. Management needs include proper seeding mixtures and rates, lime and fertilizer, control of weeds, and control of grazing.

This soil is well suited to woodland, and the potential productivity is high. Preferred trees include eastern white pine, yellow-poplar, loblolly pine, black walnut, white oak,

and northern red oak. Competition from undesirable trees is a concern in management.

This soil is poorly suited to many urban uses because of the hazard of flooding. Permanent structures can be protected from floods by dikes and levees, but this is expensive. In some places, the hazard of flooding is slight, and the cost of protection is small.

This Pope soil is in capability subclass IIw and in woodland suitability group 2o.

RcC2—Rosine and Caneyville silt loams, 6 to 12 percent slopes, eroded. This map unit is made up of sloping, deep and moderately deep soils that have a clayey subsoil. If both soils are in the same mapped area, Rosine soil makes up a higher percentage of the area than does Caneyville soil. Rosine soil is throughout the county, and Caneyville soil is mostly in the northern part of the county along the Rough Creek Fault Zone. Slopes are generally 200 to 500 feet long, and individual areas are 5 to 20 acres.

Rosine soil makes up about 50 percent of the map unit. Typically, the surface layer is very dark grayish brown silt loam 1 inch thick. The subsurface layer is brown silt loam to a depth of 4 inches. The subsoil to a depth of 22 inches is strong brown silty clay loam. To a depth of 30 inches, it is yellowish brown silty clay that has light brownish gray mottles, and to a depth of 50 inches, it is strong brown silty clay that has light gray and pale brown mottles. The substratum, to a depth of about 60 inches, is gray and strong brown shaly silty clay loam. Gray shale is at a depth of 60 inches.

Rosine soil has a deep root zone. The available water capacity is moderate. Permeability is moderately slow. This soil is low in organic matter content and medium in natural fertility. It is strongly acid or very strongly acid except in areas that have been limed.

Caneyville soil makes up about 25 percent of the map unit. Typically, the surface layer is dark brown silt loam 5 inches thick. The subsoil to a depth of 12 inches is yellowish red clay. To a depth of 30 inches, it is reddish brown clay that has dark brown mottles. Limestone bedrock is at a depth of 30 inches.

Caneyville soil has a moderately deep root zone. The available water capacity is moderate. The permeability is moderately slow. The organic matter content is low, and the natural fertility is medium. This soil ranges from very strongly acid to slightly acid in the upper part of the soil and is medium acid or slightly acid in the lower part.

Included with these soils in mapping are a few areas of Frondorf and Wellston soils and a few areas of severely eroded Caneyville and Rosine soils. Also included are soils that are deeper to bedrock than the Rosine and Caneyville soils and a few areas of limestone rock outcrop. The included soils make up about 25 percent of the map unit.

Most of the Rosine and Caneyville soils have been cultivated. Many areas are now in brush and young trees. A few areas have been used as sites for houses, and a few areas are in pasture.

These soils are suited to most crops that are grown in the survey area. Erosion is a severe hazard if these soils are cultivated; however, crops can be grown if intensive erosion control measures are used. These soils can be worked over a wide range of moisture content without crusting and clodding except in areas where the clayey subsoil has been exposed by erosion.

These soils are suited to most hay and pasture plants that are grown in the survey area area. Contour cultivation, proper seeding, lime and fertilizer, control of grazing, and control of weeds are the major management needs.

These soils are suited to woodland, and the potential productivity is high for Rosine soil and moderate for Caneyville soil. Slopes generally do not limit the use of equipment. Trees to plant include eastern white pine, shortleaf pine, yellow-poplar, white ash, white oak, northern red oak, and loblolly pine on Rosine soil and eastern redcedar, Virginia pine, and loblolly pine on Caneyville soil.

These soils have limitations for most urban uses because of the depth to bedrock, slope, and clayey subsoil. Bedrock is at a depth of 20 to 40 inches in Caneyville soil, which is a severe limitation for structures that require a deep excavation. Because of the slope, considerable cutting and filling is needed for large buildings. Shrinking and swelling and low strength as it affects local roads and streets are limitations, but they can be overcome by good design and proper installation. The moderately slow permeability is a limitation for septic tank filter fields. This limitation can be overcome by increasing the size or modifying the filter field. Rosine soil is better suited to most urban uses than Caneyville soil.

Rosine soil is in capability subclass IIIe, and Caneyville soil is in capability subclass IVe. Rosine soil is in woodland suitability group 2o, and Caneyville soil is in woodland suitability group 4c.

RcD2—Rosine and Caneyville silt loams, 12 to 20 percent slopes, eroded. This map unit is made up of moderately steep, deep and moderately deep soils on uplands. If both soils are in the same mapped area, Rosine soil makes up a higher percentage of the area than does Caneyville soil. Rosine soil is throughout the county, and Caneyville soil is mostly in the northern part of the county along the Rough Creek Fault Zone. Slopes are generally 200 to 500 feet long, and individual areas are 5 to 20 acres.

Rosine soil makes up about 50 percent of the map unit. Typically, the surface layer is very dark grayish brown silt loam 1 inch thick. The subsurface layer is brown silt loam to a depth of 4 inches. The subsoil to a depth of 22 inches is strong brown silty clay loam. To a depth of 30 inches, it is yellowish brown silty clay that

has light brownish gray mottles, and to a depth of 50 inches, it is strong brown silty clay that has light gray and pale brown mottles. The substratum, to a depth of about 60 inches, is gray and strong brown shaly silty clay loam. Gray shale is at a depth of 60 inches.

Rosine soil has a deep root zone. The available water capacity is high. Permeability is moderately slow. This soil is low in organic matter content and medium in natural fertility. It is strongly acid or very strongly acid except in areas that have been limed.

Caneyville soil makes up about 25 percent of the map unit. Typically, the surface layer is dark brown silt loam 5 inches thick. The subsoil to a depth of 12 inches is yellowish red clay. To a depth of 30 inches, it is reddish brown clay that has dark brown mottles. Limestone bedrock is at a depth of 30 inches.

Caneyville soil has a moderately deep root zone. The available water capacity is moderate. The permeability is moderately slow. The organic matter content is low, and natural fertility is medium. This soil ranges from very strongly acid to slightly acid in the upper part of the soil and is medium acid or slightly acid in the lower part.

Included with these soils in mapping are a few areas of Frondorf and Wellston soils and a few areas of severely eroded Caneyville and Rosine soils. Also included are soils that are deeper to bedrock and a few areas of limestone rock outcrop. The included soils make up about 25 percent of the map unit.

Most areas of these Rasine and Caneyville soils are in woodland. Many areas have been cultivated but are now in brush and young trees. A few areas are in pasture.

These soils are poorly suited to cultivated crops. Most crops that grow in the survey area will grow on these soils; however, because erosion is a severe hazard these soils generally are not suited to cultivation.

These soils are well suited to hay and pasture. They are suited to most grasses and legumes that are grown in the survey area. Grasses and legumes respond to lime and fertilizer. Overgrazing of pastures and frequent renovation generally result in erosion. The main management needs are proper seeding rates and mixtures, contour cultivation, lime and fertilizer, control of weeds, and control of grazing.

These soils are suited to woodland, and potential productivity is high to moderately high. Preferred trees include eastern white pine, shortleaf pine, yellow-poplar, white ash, white oak, northern red oak, and loblolly pine on cool slopes, and white oak, shortleaf pine, loblolly pine, eastern redcedar, and Virginia pine on warm slopes. Because of the moderately steep slopes, erosion is a hazard during harvest of timber products. Slope is a limitation to the use of equipment.

These soils are poorly suited to most urban uses because of the depth to bedrock, slope, and clayey subsoil. Because of the slope, cutting and filling is needed for many uses. Bedrock is at a depth of 20 to 40 inches in Caneyville soil, and deep cuts cannot be made unless the bedrock can be excavated. Shrinking and swelling and low strength as it affects local roads and streets are limitations, but they can be overcome by good design and proper installation. Rosine soil is better suited to some urban uses than Caneyville soil.

Rosine soil is in capability subclass IVe, and Caneyville soil is in capability subclass VIe. Rosine soil is in woodland suitability groups 2r (north slopes) and 3r (south slopes), and Caneyville soil is in woodland suitability groups 3c (north slopes) and 4c (south slopes).

RoC3—Rosine and Caneyville soils, 6 to 12 percent slopes, severely eroded. This map unit is made up of sloping, deep and moderately deep soils on uplands. The clayey subsoil has been exposed by erosion. If both soils are in the same mapped area, Rosine soil makes up a higher percentage of the area than does Caneyville soil. Rosine soil is throughout the county, and Caneyville soil is mostly in the northern part of the county along the Rough Creek Fault Zone. Slopes are generally 200 to 500 feet long, and individual areas are 5 to 20 acres.

Rosine soil makes up about 50 percent of the map unit. Typically, the surface layer is strong brown silty clay loam about 8 inches thick. The subsoil to a depth of 12 inches is strong brown silty clay loam. To a depth of 20 inches, it is yellowish brown silty clay that has light brownish gray mottles, and to a depth of 40 inches, it is strong brown silty clay that has light gray and pale brown mottles. The substratum, to a depth of about 50 inches, is gray and strong brown shaly silty clay loam. Gray shale is at a depth of 50 inches.

Rosine soil has a deep root zone. The available water capacity is high. Permeability is moderately slow. This soil is very low in organic matter content and medium in natural fertility. It is strongly acid or very strongly acid except in areas that have been limed.

Caneyville soil makes up about 25 percent of the map unit. Typically, the surface layer is yellowish red silty clay 8 inches thick. The subsoil, to a depth of 22 inches, is reddish brown clay that has dark brown mottles. Limestone bedrock is at a depth of 22 inches.

Caneyville soil has a moderately deep root zone. The available water capacity is moderate. Permeability is moderately slow. The organic matter content is very low, and the natural fertility is medium. This soil ranges from strongly acid to slightly acid in the upper part of the soil and is medium acid or slightly acid in the lower part.

Included with these soils in mapping are a few areas of Frondorf and Wellston soils. Soils that are deeper to bedrock and a few rock outcrops of limestone are included. Also included are a few gullied areas where the original soil has been eroded away and bedrock is exposed. The included soils make up about 25 percent of the map unit.

These Rosine and Caneyville soils generally are poorly suited to cultivated crops. The clayey subsoil has been

exposed by erosion, and the plow layer is sticky when wet and hard when dry. Because of the slope, additional erosion is a hazard.

These soils are suited to most hay and pasture plants that are grown in the survey area. Contour cultivation, proper seeding, lime and fertilizer, control of grazing, and control of weeds are the major management needs.

These soils are suited to woodland, and the potential productivity is moderate to high. Equipment use limitations, seedling mortality, and plant competition are management concerns. Preferred trees include eastern white pine, shortleaf pine, loblolly pine, white ash, white oak, and northern red oak on Rosine soil and eastern redcedar, Virginia pine, and loblolly pine on Caneyville soil.

These soils have limitations for most urban uses because of the depth to bedrock, slope, and clayey subsoil. Caneyville soil has bedrock at a depth of 20 to 40 inches. This is a severe limitation for structures that require deep excavation. Because of the slope, considerable cutting and filling is needed for large buildings. Shrinking and swelling and low strength as it affects local roads and streets are limitations, but they can be overcome by good design and proper installation. The moderately slow permeability is a limitation for septic tank filter fields. This can be overcome by increasing the size or modifying the filter field. Rosine soil is better suited to most urban uses than Caneyville soil.

The Rosine soil is in capability subclass IVe, and the Caneyville soil is in capability subclass VIe. Rosine soil is in woodland suitability group 3o, and Caneyville soil is in woodland suitability group 5c.

RoD3—Rosine and Caneyville soils, 12 to 20 percent slopes, severely eroded. This map unit is made up of moderately steep, deep and moderately deep soils on uplands. The clayey subsoil has been exposed by erosion. If both soils are in the same mapped area, Rosine soil makes up a higher percentage of the area than does Caneyville soil. Rosine soil is throughout the county, and Caneyville soil is mostly in the northern part of the county along the Rough Creek Fault Zone. Slopes are generally 200 to 500 feet long, and individual areas are 5 to 20 acres.

Rosine soil makes up about 50 percent of the map unit. Typically, the surface layer is strong brown silty clay loam about 8 inches thick. The subsoil to a depth of 12 inches is strong brown silty clay loam. To a depth of 20 inches, it is yellowish brown silty clay that has light brownish gray mottles, and to a depth of 40 inches, it is strong brown silty clay that has light gray and pale brown mottles. The substratum, to a depth of about 50 inches, is gray and strong brown shaly silty clay loam. Gray shale is at a depth of 50 inches.

Rosine soil has a deep root zone. The available water capacity is high. Permeability is moderately slow. This soil is very low in organic matter content and medium in natural fertility. It is strongly acid or very strongly acid except in areas that have been limed.

Caneyville soil makes up about 25 percent of the map unit. Typically, the surface layer is yellowish red silty clay 8 inches thick. The subsoil, to a depth of 22 inches, is reddish brown clay that has dark brown mottles. Limestone bedrock is at a depth of 22 inches.

Caneyville soil has a moderately deep root zone. The available water capacity is moderate. The permeability is moderately slow. The organic matter content is very low, and the natural fertility is medium. This soil ranges from very strongly acid to slightly acid in the upper part of the soil and is medium acid or slightly acid in the lower part.

Included with these soils in mapping are a few areas of Frondorf and Wellston soils. Soils that are deeper to bedrock and a few rock outcrops of limestone are included. Also included are a few gullied areas where the original soil has been eroded away and bedrock is exposed. The included soils make up abut 25 percent of the map unit.

These Rosine and Caneyville soils generally are not suited to cultivated crops. The clayey subsoil has been exposed by erosion, and the plow layer is sticky when wet and hard when dry. Because of the slope, additional erosion is a hazard.

These soils are suited to most hay and pasture plants that are grown in the survey area. Contour cultivation, proper seeding, lime and fertilizer, control of grazing, and control of weeds are the major management needs.

These soils are suited to woodland, and the potential productivity is moderate to high. The hazard of erosion, equipment use limitations, seedling mortality, and plant competition are management concerns. Preferred trees include white ash, white oak, northern red oak, eastern white pine, shortleaf pine, and loblolly pine on cool slopes and eastern redcedar, Virginia pine, shortleaf pine, white oak, and loblolly pine on warm slopes.

These soils have limitations for most urban uses because of the depth to bedrock, slope, and clayey subsoil. In Caneyville soil, bedrock is at a depth of 20 to 40 inches. This is a severe limitation for structures that require deep excavation. Because of the slope, considerable cutting and filling is needed for large buildings. Shrinking and swelling and low strength as it affects local roads and streets are limitations, but they can be overcome by good design and proper installation. The moderately slow permeability is a limitation for septic tank filter fields. This can be overcome by increasing the size or modifying the filter field. Rosine soil is better suited to most urban uses than Caneyville soil.

This map unit is in capability subclass VIe. Rosine soil is in woodland suitability groups 3r (north slopes) and 4r (south slopes), and Caneyville soil is in woodland suitability groups 4c (north slopes) and 5c (south slopes).

SaB2—Sadler silt loam, 2 to 6 percent slopes, eroded. This deep, gently sloping, moderately well drained soil is on broad hilltops, in saddles, and on terraces scattered throughout the county. Individual areas are mostly 5 to 30 acres. Slopes are generally 100 to 300 feet long.

Typically, the surface layer is brown silt loam 8 inches thick. The subsoil extends to a depth of 60 inches. To a depth of 26 inches, it is yellowish brown and brown silt loam. Between depths of 26 and 45 inches is a mottled dark yellowish brown and gray silt loam fragipan. Below that, the subsoil is mottled yellowish brown, light brownish gray, and dark yellowish brown gravelly silty clay loam. Sandstone bedrock is at a depth of 60 inches.

This soil has moderate permeability above the fragipan and slow permeability in the fragipan. Runoff is medium. This soil has a moderately deep root zone to the fragipan. The available water capacity is moderate. The organic matter content is low. This soil is medium in natural fertility. It is strongly acid or very strongly acid except in areas that have been limed.

Included with this soil in mapping are small, severely eroded areas that have the original subsoil mixed with the plow layer. Also included are small areas of Calloway, Hosmer, Stendal, and Zanesville soils. Sadler soils that have 0 to 2 percent slopes are included. This map unit includes soils that are 40 to 50 inches to bedrock; soils that are underlain by soft, rippable bedrock; and soils that are clayey in the substratum. The included soils make up about 20 to 30 percent of the map unit.

Most of this Sadler soil is farmed. It is used for corn, soybeans, hay, and pasture. Many farm buildings are constructed on this soil.

This soil is well suited to cultivated crops; however, erosion is a moderate hazard. Crops respond to lime and fertilizer. The plow layer is easy to till, and this soil can be worked over a wide range of moisture content. Conservation tillage, contour cultivation, stripcropping, cover crops, addition of organic matter, grassed waterways, and grasses and legumes in the rotation system reduce runoff and help to control erosion.

This soil is well suited to woodland, and the potential productivity is moderately high. Preferred trees include eastern white pine, shortleaf pine, yellow-poplar, white oak, northern red oak, and loblolly pine. Plant competition is a managment concern.

This soil is suited to most urban uses. Because this soil is gently sloping and is above the flood plain, it is desirable as sites for buildings. The slow permeability and seasonal high water table above the fragipan are severe limitations for septic tank filter fields, but these limitations can be overcome by enlarging the absorption area or modifying the filter field. The seasonal high water table in winter and early in spring is a limitation for some uses. Depth to bedrock is a limitation for uses that require deep excavation.

This Sadler soil is in capability subclass IIe and in woodland suitability group 3o.

Sf—Steff silt loam, occasionally flooded. This deep, moderately well drained, nearly level soil is on flood plains. Slopes are mostly 0 to 2 percent, but range up to 4 percent. This soil formed in alluvium that washed from adjacent uplands. Most areas of this soil are near the base of hills, in narrow valleys in hilly areas, or in narrow strips near large streams. Individual areas are 200 to 400 feet wide, 500 to 2,000 feet long, and contain about 10 to 30 acres.

Typically, the surface layer is yellowish brown silt loam about 8 inches thick. The subsoil to a depth of 20 inches is brown silt loam that has light gray mottles. To a depth of 50 inches, it is mottled light brownish gray and brown silt loam. The substratum to a depth of 60 inches is mottled light gray and brown silt loam.

This soil has a deep root zone. The available water capacity is high. The organic matter content is low, and natural fertility is medium. This soil is strongly acid or very strongly acid except in areas that have been limed. It has moderate permeability. Runoff is slow. This soil has a seasonal high water table and is subject to occasional flooding.

Included with this soil in mapping are a few areas of Clifty, Cuba, and Stendal soils. Also included are small areas of soils similar to Steff soil; some have more sand throughout the profile, some have more clay in the subsoil, and others have less acid in the subsoil. The included soils make up about 15 to 25 percent of the map unit.

Most of this Steff soil is used for cultivated crops. Important crops are corn and soybeans. Some areas are in hay or pasture, and a few areas are in woodland. A few buildings are constructed on this soil.

This soil is well suited to cultivated crops (fig. 10). The erosion hazard is slight, and this soil can be cultivated in short rotations without loss of soil. This soil is subject to occasional flooding. Generally flooding is in winter or spring when row crops are not growing and is of short duration. Most crops respond to lime and fertilizer. Drainage improves the suitability for some crops. The plow layer is easy to till and can be worked over a wide range of moisture content. Cover crops and return of crop residue increase the content of organic matter and improve the tilth.

This soil is well suited to hay and pasture. It is suited to most grasses and legumes that are grown in the survey area; however, in some years perennials are damaged by winter floods. Management needs include proper seeding mixtures and rates, lime and fertilizer, control of weeds, and control of grazing.

This soil is well suited to woodland, and the potential productivity is very high. Preferred trees include yellow-poplar, eastern white pine, loblolly pine, sweetgum, and cherrybark oak. There is competition from undesirable

Figure 10.—Tobacco on Steff silt loam, occasionally flooded.

trees. Most harvesting is done in summer and fall because the soil is wet in winter.

This soil is poorly suited to many urban uses because of the hazard of flooding and the seasonal high water table. In most years, this soil is flooded in winter and spring. Permanent structures can be protected from floods by dikes and levees, but this is expensive. In some places, the hazard of flooding is slight, and the cost of protection is small. Generally, the lower part of the subsoil is saturated for several weeks in winter. Surplus water can be removed by ditches and tile drains.

This Steff soil is in capability subclass IIw and in woodland suitability group 1o.

Sn—Stendal silt loam, occasionally flooded. This nearly level, deep, somewhat poorly drained soil is on flood plains. Slopes are 0 to 2 percent. This soil formed in alluvium that washed from adjacent uplands (fig. 11). Most areas of this soil include the entire width of the valley. Individual areas of this soil are generally 200 to 1,000 feet wide and 0.25 mile to 3 miles long.

Typically, the surface layer is dark brown silt loam about 8 inches thick. The underlying material to a depth of 12 inches is brown silt loam. To a depth of 65 inches or more, it is light brownish gray and gray silt loam that has yellowish brown mottles.

This soil has moderate permeability. Runoff is slow. The available water capacity is high. Natural fertility is medium, and the organic matter content is low. The root zone is deep except when it is limited by the water table. This soil is strongly acid or very strongly acid except in areas that have been limed. It has a seasonal high water table and is subject to occasional flooding.

Included with this soil in mapping are a few areas of Bonnie, Cuba, Newark, and Steff soils. Also included are some unnamed soils; some have more sand throughout the profile than the Stendal soil, some have more clay in the underlying material, and others have underlying material that is stratified. Soils that have 5 to 15 percent pebbles throughout are included mainly in the southern

Figure 11.—Pasture, tobacco, and corn on Stendal silt loam, occasionally flooded.

part of the survey area. The included soils make up about 15 to 25 percent of the map unit.

This Stendal soil is used mostly for corn, soybeans, hay, and pasture. A few areas are in woodland.

This Stendal soil is well suited to most summer annuals. It is not subject to erosion and is suited to intensive cultivation. This soil is generally flooded in winter or spring, which limits the use of this soil for perennials. The seasonal high water table also limits the suitability for some plants and delays planting in some years. If this soil is adequately drained, it is suited to most of the locally grown crops. Most crops respond well to lime and fertilizer. The plow layer is easy to till and can be worked over a wide range of moisture content. Cover crops and the return of crop residue increase the content of organic matter and improve the tilth.

This soil is well suited to most hay and pasture plants that are grown in the survey area. However, the seasonal high water table and the hazard of flooding are limitations for some plants. The main management needs are proper seeding rates and mixtures, lime and fertilizer, control of weeds, and rotation of pastures.

This soil is well suited to woodland, and the potential productivity is high. Preferred trees include eastern white pine, American sycamore, baldcypress, and green ash. Undesirable trees can be controlled by site preparation, spraying, cutting, or girdling. Most trees are harvested in summer or fall because the use of equipment is limited during wet seasons.

This soil is poorly suited to most urban uses because of the seasonal high water table and the hazard of flooding. In most winters, the subsoil is saturated for several weeks. The surplus water can be removed by

ditches and tile drains; but for some uses, such as buildings with basements and septic tanks, this is not practical. In some years, this soil is flooded in winter or early in spring. Permanent urban structures can be protected from floods by dikes and levees. In some places, the hazard of flooding is slight, and the cost of protection is small.

This Stendal soil is in capability subclass IIw and in woodland suitability group 2w.

Wb—Weinbach silt loam. This deep, nearly level, somewhat poorly drained soil is on stream terraces. Slopes are mostly 0 to 2 percent, but range to 4 percent. This soil formed in alluvium deposited by the large streams. It is mostly on low, convex ridges 200 to 800 feet wide and 1,000 to 4,000 feet long.

Typically, this soil has a surface layer of brown silt loam 9 inches thick. The subsoil extends to a depth of 60 inches or more. To a depth of 22 inches, it is mottled light brownish gray and yellowish brown silt loam. Between depths of 22 and 40 inches is a fragipan that is light brownish gray silt loam that has dark grayish brown mottles. Below that the subsoil is mottled light brownish gray and strong brown silt loam.

This soil has moderate permeability above the fragipan and slow permeability in the fragipan. Runoff is slow. The available water capacity is moderate. The root zone is moderately deep to the fragipan. The organic matter content is low, and the natural fertility is medium. This soil is strongly acid or very strongly acid except in areas that have been limed. It has good tilth and workability. It has a seasonal high water table above the fragipan. Most areas of this soil are rarely flooded.

Included with this soil in mapping are soils that are medium acid to neutral in the substratum, soils that are mostly brown in the subsoil, and soils that have a weakly developed fragipan. Also included are small areas of Henshaw, Melvin, Newark, and Otwell soils and small areas of poorly drained soils on stream terraces. The included soils make up about 15 to 25 percent of the map unit.

Most of this Weinbach soil is used for corn and soybeans. A few areas are in hay or woodland.

This soil is suited to cultivated crops. The erosion hazard is slight, and this soil can be cultivated in short rotation. Because of the seasonal high water table, this soil is not well suited to crops that require a well drained soil. It is suited to most of the row crops that are grown in the survey area; however, drainage improves the suitability for some crops. This soil can be worked over a wide range of moisture content without crusting or clodding. Crops respond well to lime and fertilizer. Important management practices include cover crops and return of crop residue.

This soil is well suited to most grasses and legumes that are common to the survey area. However, because of the moderate depth of the root zone and the seasonal high water table, this soil is not well suited to plants that require a deep, well drained soil. Most plants grow best where the excess water has been removed. Some perennials are damaged by floods. Management needs are proper seeding, lime and fertilizer, control of grazing, and control of weeds.

This soil is well suited to woodland, and the potential productivity is high. Preferred trees include eastern white pine, baldcypress, green ash, yellow-poplar, and American sycamore. Undesirable trees, shrubs, and vines can be controlled by site preparation, spraying, cutting, or girdling. Most harvesting is done in summer and fall because the soil is wet in winter.

This soil is poorly suited to urban uses because of the hazard of flooding and the seasonal high water table. Most of this soil is rarely flooded, but flooding can last for several days. Most permanent urban structures can be protected from floods by dikes and levees. Generally, the subsoil is saturated for several weeks in winter. This is a limitation for most urban uses. Slow permeability in the fragipan is a limitation for septic tank filter fields.

This Weinbach soil is in capability subclass IIw and in woodland suitability group 2w.

WeC2—Wellston silt loam, 6 to 12 percent slopes, eroded. This deep, sloping, well drained soil is on uplands throughout the county. On hilltops, this soil is in convex areas that are 200 to 500 feet wide. On side slopes, areas of this soil are 100 to 500 feet wide and extend several hundred feet around the hill. Slopes are mostly 100 to 300 feet long. Individual areas are 5 to 50 acres.

Typically, the surface layer is dark grayish brown silt loam 2 inches thick. The subsurface layer is silt loam to a depth of 6 inches. The subsoil extends to a depth of 45 inches. It is brown silt loam in the upper part and dark yellowish brown silt loam in the lower part. The substratum, to a depth of 65 inches, is mottled yellowish brown and gray silt loam. Sandstone bedrock is at a depth of 65 inches.

This soil has moderate permeability. Runoff is medium. The root zone is deep, and available water capacity is high. This soil is low in organic matter content and medium in natural fertility. It is very strongly acid to medium acid except in areas that have been limed.

Included with this soil in mapping are small areas of Frondorf, Rosine, Stendal, and Zanesville soils. Also included are deep soils that have a silty clay substratum. Soils that have more slope and soils that have less slope than Wellston soil are included. This map unit includes small areas of soils that are severely eroded and have a thinner surface layer and subsoil than Wellston soil. Some severely eroded soils are identified on the soil map with a spot symbol. Also included are soils that are underlain by soft, rippable bedrock or that are deeper to bedrock than Wellston soil. The included soils make up about 20 to 30 percent of the map unit.

This Wellston soil is used for corn, hay, or pasture or as woodland. Some areas on hilltops are used for tobacco or as sites for farm buildings.

This soil is suited to cultivated crops; however, erosion is a severe hazard. Crops respond to lime and fertilizer. The plow layer is easy to till and can be worked over a wide range of moisture content. Conservation tillage, contour cultivation, stripcropping, cover crops, addition of organic matter, grassed waterways, and grasses and legumes in the rotation system reduce runoff and help to control erosion.

This soil is well suited to hay and pasture. It is suited to most grasses and legumes that are grown in the survey area. The main management needs are proper seeding mixtures and rates, lime and fertilizer, control of weeds, and control of grazing.

This soil is well suited to woodland, and the potential productivity is high. Preferred trees include eastern white pine, black walnut, yellow-poplar, white oak, northern red oak, loblolly pine, and white ash. Tree seeds and seedlings survive and grow well if competing vegetation is controlled or removed.

This soil is suited to most urban uses. Because of the slope, grading and leveling are needed for some urban uses. Erosion is a hazard during construction unless precautionary measures are taken. Temporary vegetative cover helps control erosion until permanent cover can be established. Depth to bedrock is also a limitation for some uses, such as buildings with basements and sanitary facilities. In some places, the bedrock can be excavated by earth-moving equipment.

This Wellston soil is in capability subclass IIIe and in woodland suitability group 2o.

WeC3—Wellston silt loam, 6 to 12 percent slopes, severely eroded. This deep, well drained, sloping soil is on hillsides and hilltops. Erosion has removed the original surface layer from more than 30 percent of the area, and in places part of the subsoil has been removed. Shallow rills and gullies 2 to 3 feet deep make up 10 to 20 percent of some areas of this soil. Individual areas range from 5 to 30 acres, and many include hillside draws. Slopes are mostly 100 to 300 feet long.

Typically, the surface layer is brown silt loam 8 inches thick. The subsoil extends to a depth of 35 inches. It is brown silt loam in the upper part and dark yellowish brown silt loam in the lower part. The substratum, to a depth of 55 inches, is mottled yellowish brown and gray silt loam. Sandstone bedrock is at a depth of 55 inches.

This soil has moderate permeability. Runoff is medium. The root zone is deep, and the available water capacity is high. This soil is very low in organic matter content and medium in natural fertility. It is very strongly acid to medium acid except in areas that have been limed.

Included with this soil in mapping are small areas of Frondorf, Rosine, Steff, Stendal, and Zanesville soils. Also included are Wellston soils that are not eroded, soils that contain more sand throughout the profile than Wellston soil, soils that have more coarse fragments in the upper part of the profile, and soils that have more clay in the lower part of the subsoil. This map unit includes soils that are extremely acid in the substratum, soils that are silty clay loam in the surface layer, and soils that are underlain by soft, rippable bedrock. The included soils make up about 20 to 30 percent of the map unit.

This Wellston soil is used for corn, hay, or pasture or as woodland. Most of this soil has been cultivated. Some of it is no longer used for farming and is in weeds, brush, and wild vegetation.

This soil is poorly suited to cultivated crops. If this soil is cultivated, erosion is a very severe hazard. Crops respond to lime and fertilizer. The plow layer is easy to till and can be worked over a wide range of moisture content. Conservation tillage, contour cultivation, stripcropping, cover crops, addition of organic matter, grassed waterways, and grasses and legumes in the rotation system reduce runoff and help to control erosion.

This soil is suited to hay and pasture. It is suited to most grasses and legumes that are grown in the survey area. The main management needs are proper seeding mixtures and rates, lime and fertilizer, control of weeds, and control of grazing.

This soil is suited to woodland, and the potential productivity is high. Some areas are reverting naturally to trees and shrubs since the soil is no longer cultivated. Desirable trees grow well if competing vegetation is removed or controlled. Preferred trees include eastern white pine, yellow-poplar, black walnut, white oak, northern red oak, white ash, and loblolly pine.

This soil is suited to most urban uses. Because of the slope, grading and leveling are needed for some uses. Depth to bedrock is a limitation for some urban uses, such as buildings with basements and sanitary facilities. In some places, the bedrock can be excavated by earth-moving equipment. Unless precautionary measures are taken, erosion is a hazard during construction. Temporary vegetation helps control erosion until permanent cover is established.

This Wellston soil is in capability subclass IVe and in woodland suitability group 2o.

WeD2—Wellston silt loam, 12 to 20 percent slopes, eroded. This deep, moderately steep, well drained soil is on uplands throughout the county. On hillsides, areas of this soil are 100 to 500 feet wide and extend several hundred feet around the hill. Individual areas are 5 to 50 acres. Slopes are mostly 200 to 500 feet long. Many of the large mapped areas are dissected by drainageways.

Typically, the surface layer is dark grayish brown silt loam 2 inches thick. The subsurface layer is silt loam to a depth of 6 inches. The subsoil extends to a depth of 45 inches. It is brown silt loam in the upper part and dark

yellowish brown silt loam in the lower part. The substratum, to a depth of 65 inches, is mottled yellowish brown and gray silt loam. Sandstone bedrock is at a depth of 65 inches.

This soil has moderate permeability. Runoff is rapid. The root zone is deep, and the available water capacity is high. This soil is low in organic matter content and medium in natural fertility. It is very strongly acid to medium acid except in areas that have been limed.

Included with this soil in mapping are small areas of Frondorf, Rosine, Stendal, and Zanesville soils. Stendal soils are mostly along drainageways. This map unit includes deep soils that have a silty clay substratum and soils that are extremely acid in the substratum. Soils that have more slope and soils that have less slope than Wellston soil are included. Small areas of soils that are severely eroded and have a thinner surface layer and subsoil are also included. Severely eroded soils are identified on the soil map with a spot symbol. Also included are soils that are underlain by soft, rippable bedrock or that are deeper to bedrock. The included soils make up about 20 to 30 percent of the map unit.

This Wellston soil is used for corn, hay, or pasture or as woodland. Some areas of this soil have been cultivated but are now in weeds, brush, and wild vegetation.

This soil is poorly suited to cultivated crops. If this soil is cultivated, erosion is a very severe hazard. Most cultivated crops that are grown in the survey area will grow on this soil. Crops respond to lime and fertilizer. The plow layer is easy to till and can be worked over a wide range of moisture content. Conservation tillage, contour cultivation, stripcropping, cover crops, addition of organic matter, grassed waterways, and grasses and legumes in the rotation system reduce runoff and help to control erosion.

This soil is well suited to hay and pasture. It is suited to most grasses and legumes that are grown in the survey area. The main management needs are proper seeding mixtures and rates, lime and fertilizer, control of weeds, and control of grazing.

This soil is suited to woodland, and the potential productivity is high to moderately high. Preferred trees include eastern white pine, black walnut, yellow-poplar, white oak, northern red oak, white ash, loblolly pine, and shortleaf pine. Undesirable trees can be controlled or removed. Erosion is a hazard on the moderately steep slopes, and the use of equipment is limited.

This soil is poorly suited to urban uses because of the slope and depth to bedrock. For most urban uses, considerable grading and leveling are needed to reduce the slope. Bedrock, which is at a depth of 40 to 72 inches, limits the amount of grading and leveling that can be done; however, in places the bedrock can be excavated by heavy equipment. Erosion is a hazard during construction unless precautionary measures are taken.

This Wellston soil is in capability subclass IVe and in woodland suitability groups 2r (north slopes) and 3r (south slopes).

WeD3—Wellston silt loam, 12 to 20 percent slopes, severely eroded. This deep, well drained, moderately steep soil is on hillsides throughout the survey area. Many areas are crossed by drainageways. Erosion has removed the original surface layer from more than 30 percent of the area, and in places part of the subsoil has been lost. Some mapped areas have rills and shallow gullies 2 to 3 feet deep that make up less than 20 percent of the area. Slopes are mostly 300 to 500 feet long. Individual areas range from 5 to 50 acres.

Typically, the surface layer is brown silt loam 8 inches thick. The subsoil extends to a depth of 35 inches. It is brown silt loam in the upper part and dark yellowish brown silt loam in the lower part. The substratum, to a depth of 55 inches, is mottled yellowish brown and gray silt loam. Sandstone bedrock is at a depth of 55 inches.

This soil has moderate permeability. Runoff is rapid. The root zone is deep, and the available water capacity is high. This soil is very low in organic matter content and medium in natural fertility. It is very strongly acid to medium acid except in areas that have been limed.

Included with this soil in mapping are small areas of Clifty, Frondorf, Hosmer, Rosine, Stendal, and Zanesville soils. Also included are Wellston soils that are not eroded, soils that have more coarse fragments in the upper part of the profile than Wellston soil, and soils that have a thin layer of water-laid gravel between the subsoil and bedrock. This map unit includes soils that are extremely acid in the substratum, Wellston soils that have a silty clay loam surface layer, and soils that are underlain by soft, rippable bedrock. The included soils make up about 20 to 30 percent of the map unit.

Most of this Wellston soil is used for hay or pasture or as woodland. Most of it has been cultivated, and some areas are still used for corn. Other areas of this soil are in weeds, brush, and wild vegetation.

This soil is poorly suited to cultivated crops. Most crops that are grown in the survey area can grow on this soil, but erosion is a severe hazard.

This soil is suited to hay and pasture. It is suited to most grasses and legumes that are grown in the survey area. The main management needs are proper seeding mixtures and rates, lime and fertilizer, control of weeds, and control of grazing. Erosion control measures are needed during seedbed preparation.

This soil is suited to woodland, and the potential productivity is high to moderately high. Preferred trees include eastern white pine, white oak, northern red oak, white ash, shortleaf pine, and loblolly pine. Undesirable trees need to be controlled or removed. Because of the moderately steep slopes, erosion is a hazard and the use of equipment is limited.

This soil is poorly suited to urban uses because of the slope and depth to bedrock. For most urban uses, considerable grading and leveling are needed to reduce the slope. Bedrock, which is at a depth of 40 to 72 inches, limits the amount of grading and leveling that can be done; however, in some places the bedrock can be excavated by heavy equipment. Erosion is a hazard during construction unless precautionary measures are taken.

This Wellston soil is in capability subclass VIe and in woodland suitability groups 3r (north slopes) and 4r (south slopes).

ZaB2—Zanesville silt loam, 2 to 6 percent slopes, eroded. This deep, gently sloping, well drained and moderately well drained soil is on hilltops and side slopes and in some toe slope positions throughout the map unit. Many areas of this soil on hilltops are long and winding and are 200 to 500 feet wide. Individual areas range from 5 to 30 acres. Slopes are mostly 100 to 200 feet long and convex.

Typically, the surface layer is brown silt loam 9 inches thick. The subsoil to a depth of 30 inches is strong brown or yellowish brown silt loam. To a depth of 40 inches, it is a yellowish brown silt loam fragipan that has brown and light brownish gray mottles. The substratum extends to a depth of 65 inches. It is yellowish brown loam in the upper part and mottled yellowish brown and red clay loam in the lower part. Sandstone bedrock is at a depth of 65 inches.

This soil has moderate permeability above the fragipan and slow permeability in the fragipan. Runoff is medium. This soil has a moderately deep root zone to the fragipan. The available water capacity is moderate. This soil is low in organic matter content and medium in natural fertility. It is strongly acid or very strongly acid except in areas that have been limed.

Included with this soil in mapping are areas of soils that are not eroded. Also included are soils that are underlain by soft, rippable bedrock and soils that have a clayey substratum. This map unit includes a few small areas of Wellston soils on points and ridges and small areas of Hosmer and Sadler soils. The included soils make up about 20 to 25 percent of this map unit.

Most of this Zanesville soil is farmed. It is used for corn, hay, and pasture. Many roads and farm buildings are constructed on this soil. Small areas of this soil are in woodland.

This soil is well suited to cultivated crops; however, erosion is a moderate hazard. Crops respond to lime and fertilizer. The plow layer is easy to till and can be worked over a wide range of moisture content. Conservation tillage, contour cultivation, stripcropping, cover crops, addition of organic matter, grassed waterways, and grasses and legumes in the rotation system reduce runoff and help to control erosion.

This soil is well suited to hay and pasture. It is suited to most grasses and legumes grown in the survey area. Some deep-rooted crops are short-lived. The main management needs are proper seeding rates and mixtures, lime and fertilizer, control of weeds, and control of grazing.

This soil is well suited to woodland, and the potential productivity is moderately high. Preferred trees include eastern white pine, shortleaf pine, and loblolly pine. Young trees grow well and survive if competing vegetation is controlled.

This soil is well suited to most urban uses. Because this soil is gently sloping and is on uplands, it is desirable as sites for buildings. The slow permeability and seasonal high water table above the fragipan are severe limitations for septic tank filter fields. These limitations can be overcome by enlarging the absorption area or modifying the filter field. The depth to bedrock is a limitation for uses that require deep excavation, such as sanitary facilities and buildings with basements. The water table is high mostly in winter and early in spring and is a limitation for some uses.

This Zanesville soil is in capability subclass IIe and in woodland suitability group 3o.

ZaC2—Zanesville silt loam, 6 to 12 percent slopes, eroded. This deep, sloping, well drained and moderately well drained soil is on hilltops and side slopes and in toe slope positions throughout the map unit. Most slopes are convex and 200 to 400 feet long. Most mapped areas range from 5 to 40 acres.

Typically, the surface layer is brown silt loam 9 inches thick. The subsoil to a depth of 30 inches is strong brown or yellowish brown heavy silt loam. To a depth of 40 inches, it is a mottled yellowish brown, brown, and light brownish gray silt loam fragipan. The substratum extends to a depth of 65 inches. It is yellowish brown loam in the upper part and mottled yellowish brown and red clay loam in the lower part. Sandstone bedrock is at a depth of 65 inches.

This soil has moderate permeability above the fragipan and slow permeability in the fragipan. Runoff is medium. This soil has a moderately deep root zone to the fragipan. The available water capacity is moderate. This soil is low in organic matter content and medium in natural fertility. It is strongly acid or very strongly acid except in areas that have been limed.

Included with this soil in mapping are small areas of severely eroded soils that have the original subsoil mixed with the plow layer. The surface layer of these soils is a brighter color and is slightly less friable than the surface layer of Zanesville soil. Also included are areas of soils that are not eroded, a few small wet areas, and a few small areas of soils that have less than 6 percent slope. This map unit includes small areas of Hosmer and Sadler soils, soils that are silty clay in the substratum, and soils that are underlain by soft, rippable bedrock.

The included soils make up about 20 to 25 percent of the map unit.

This Zanesville soil is used for corn, hay, or pasture or as woodland. Some areas on hilltops are used for tobacco or as sites for farm buildings.

This soil is suited to cultivated crops; however, erosion is a severe hazard. Crops respond to lime and fertilizer. The plow layer is easy to till and can be worked over a wide range of moisture content. Conservation tillage, contour cultivation, stripcropping, cover crops, addition of organic matter, grassed waterways, and grasses and legumes in the rotation system reduce runoff and help to control erosion.

This soil is well suited to hay and pasture (fig. 12). It is suited to most grasses and legumes that are grown in the survey area. Some deep-rooted crops are short-lived. The main management needs are proper seeding rates and mixtures, lime and fertilizer, control of weeds, and control of grazing.

This soil is well suited to woodland, and the potential productivity is moderately high. Preferred trees include eastern white pine, shortleaf pine, and loblolly pine. Young trees grow well and survive if competing vegetation is controlled.

This soil is well suited to most urban uses (fig. 13). Because this soil is on uplands, it is desirable as a site for buildings. Because of the slope, grading and leveling are needed for some urban uses. The depth to bedrock is a limitation for some uses and in places limits the amount of grading and leveling that is possible. This soil has a severe limitation for septic tank filter fields because of the slow permeability of the fragipan. The layer above the fragipan is saturated in wet seasons, but generally this limitation can be overcome by good design and proper installation.

This Zanesville soil is in capability subclass IIIe and in woodland suitability group 3o.

ZaC3—Zanesville silt loam, 6 to 12 percent slopes, severely eroded. This deep, sloping, well drained and moderately well drained soil is mostly on side slopes on uplands throughout the county. Slopes are generally 200 to 400 feet long. Erosion has removed the original surface layer from more than 30 percent of the area, and in places part of the subsoil has been removed. Some mapped areas have gullies 2 to 3 feet deep that make up 10 to 20 percent of the area.

Typically, the surface layer is strong brown silt loam about 8 inches thick. The subsoil to a depth of 20 inches is strong brown or yellowish brown silt loam. To a depth of 30 inches, it is a mottled brown, yellowish brown, and light brownish gray silt loam fragipan. The substratum

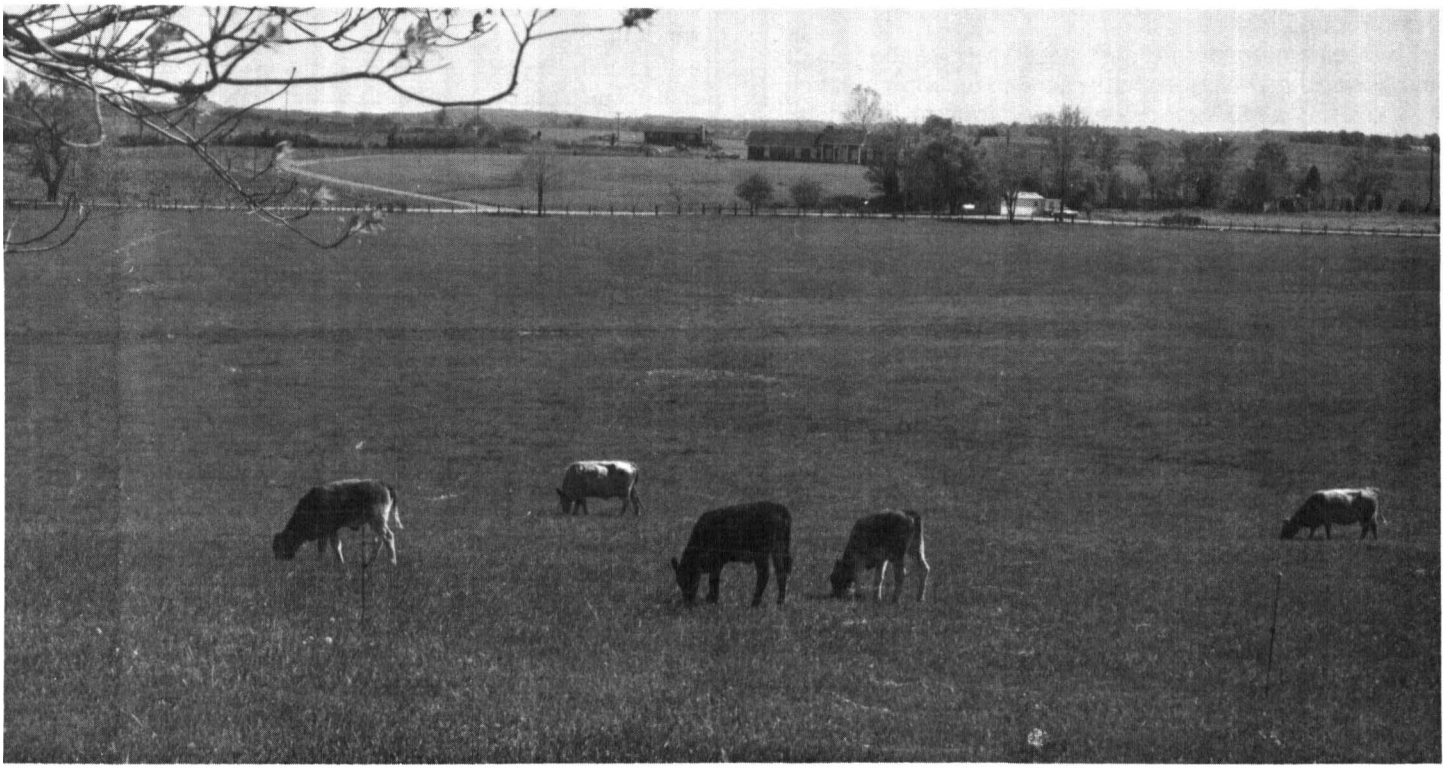


Figure 12.—Pasture on Zanesville silt loam, 6 to 12 percent slopes, eroded.

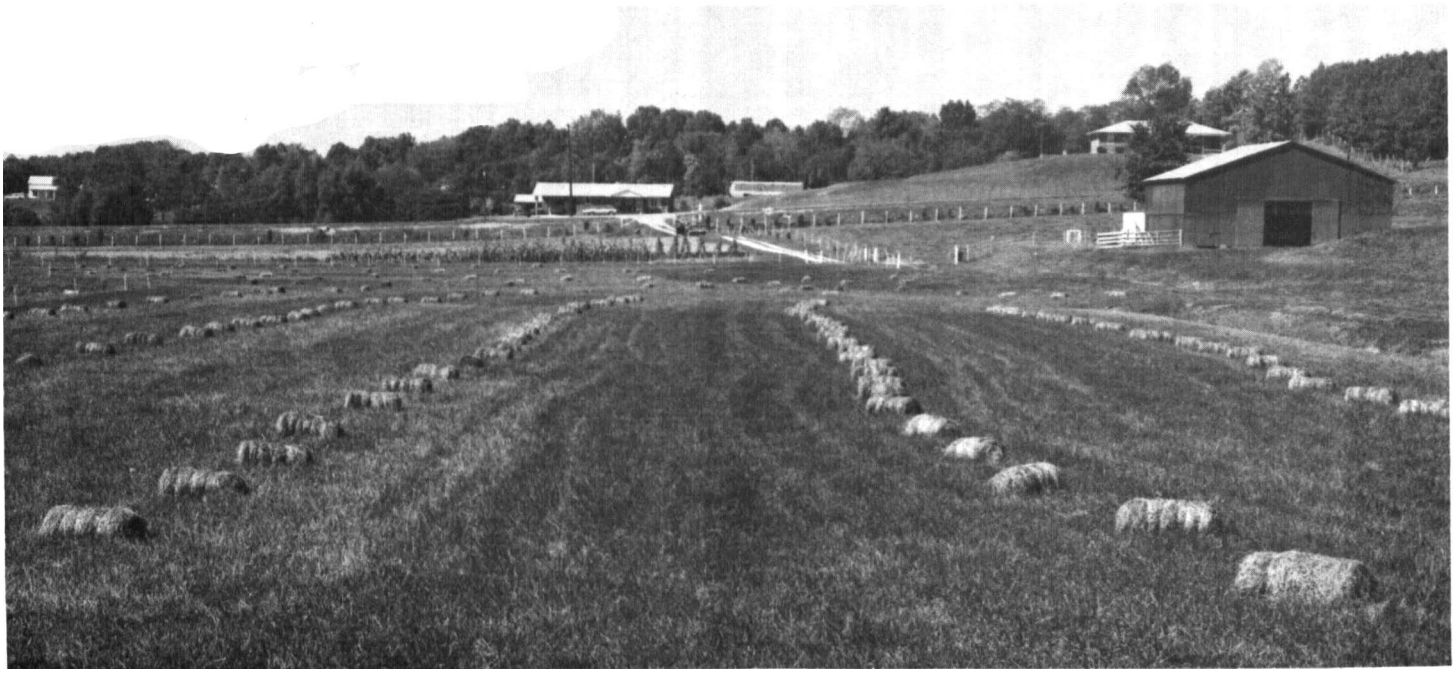


Figure 13.—Buildings and permanent vegetation on Zanesville silt loam, 6 to 12 percent slopes, eroded. Steff silt loam, occasionally flooded, is in the foreground.

extends to a depth of 55 inches. It is yellowish brown loam in the upper part and mottled yellowish brown and red clay loam in the lower part. Sandstone bedrock is at a depth of 55 inches.

This soil has moderate permeability above the fragipan and slow permeability in the fragipan. Runoff is medium. This soil has a shallow root zone to the fragipan. The available water capacity is low. This soil is very low in organic matter content and medium in natural fertility. It is strongly acid or very strongly acid except in areas that have been limed.

Included with this soil in mapping are some areas of Hosmer, Sadler, and Wellston soils. Some mapped areas include uneroded soils between gullies and near the bottom of the slope. Also included are soils that have a substratum of silty clay and soils that are underlain by soft, rippable bedrock. Long, narrow bands of Stendal and Steff soils are included along waterways and in low places. Zanesville soils that have slopes of 4 to 6 percent or 12 to 15 percent are also included. Soils that are 30 to 40 inches deep to bedrock and have a fragipan at a depth of 10 to 20 inches are included in the most severely eroded places. The included soils make up about 20 to 25 percent of the map unit.

Most of this Zanesville soil has been cultivated. Some areas are still farmed, and some areas are in weeds, brush, and wild vegetation. Crops include corn, hay, and pasture.

This soil is poorly suited to cultivated crops. If the soil is cultivated, erosion is a very severe hazard. Conservation tillage, contour cultivation, stripcropping, cover crops, addition of organic matter, grassed waterways, and grasses and legumes in the rotation system reduce runoff and help to control erosion.

This soil is suited to hay and pasture. It is suited to most grasses and legumes that are grown in the survey area. Some deep-rooted crops are short-lived. The main management needs are proper seeding rates and mixtures, lime and fertilizer, control of weeds, and control of grazing.

This soil is suited to woodland, and the potential productivity is moderate. Some areas of this soil are reverting naturally to trees and shrubs that have volunteered since the soil was abandoned as cultivated land. Preferred trees include Virginia pine, shortleaf pine, and loblolly pine.

This soil is suited to most urban uses. Because of the slope, grading and leveling are needed for some urban uses. The depth to bedrock is a limitation for some uses and in places limits the amount of grading and leveling that is possible. Excess water above the fragipan is a limitation, but this can be overcome by good design and installation.

This Zanesville soil is in capability subclass IVe and in woodland suitability group 4o.

Prime Farmland

In this section, prime farmland is defined and discussed. The prime farmland soils in Ohio County are listed in table 5.

Prime farmland is one of several kinds of important farmland defined by the U.S. Department of Agriculture. It is of major importance in meeting the nation's short- and long-range needs for food and fiber. The acreage of high-quality farmland is limited, and the U.S. Department of Agriculture recognizes that government at local, state, and federal levels, as well as individuals, must encourage and facilitate the wise use of our nation's prime farmland.

Prime farmland soils, as defined by the U.S. Department of Agriculture, are soils that are best suited to producing food, feed, forage, fiber, and oilseed crops. Such soils have properties that are favorable for the economic production of sustained high yields of crops (fig. 14). The soils need only to be treated and managed using acceptable farming methods. The moisture supply, of course, must be adequate, and the growing season has to be sufficiently long. Prime farmland soils produce the highest yields with minimal inputs of energy and economic resources. Farming these soils results in the least damage to the environment.

Figure 14.—Burley tobacco on prime farmland. The soil is Steff silt loam, occasionally flooded.

Prime farmland soils may presently be in use as cropland, pasture, or woodland, or they may be in other uses. They either are used for producing food or fiber or are available for these uses. Urban or built-up land, public land, and water areas cannot be considered prime farmland. Urban or built-up land is any contiguous unit of land 10 acres or more in size that is used for such purposes as housing, industrial and commercial sites, sites for institutions or public buildings, small parks, golf courses, cemeteries, railroad yards, airports, sanitary landfills, sewage treatment plants, and water control structures. Public land is land not available for farming in national forests, national parks, military reservations, and state parks.

Prime farmland soils usually get an adequate and dependable supply of moisture from precipitation or irrigation. The temperature and growing season are favorable. The acidity or alkalinity level of the soils is acceptable. The soils have few or no rocks and are permeable to water and air. They are not excessively erodible or saturated with water for long periods and are not subject to frequent flooding during the growing season. The slope ranges mainly from 0 to 6 percent.

Soils that have a high water table, are subject to flooding, or are droughty may qualify as prime farmland soils if the limitations or hazards are overcome by drainage, flood control, or irrigation. Onsite evaluation is necessary to determine the effectiveness of corrective measures. More information on the criteria for prime farmland soils can be obtained at the local office of the Soil Conservation Service.

About 125,000 acres, or 33 percent, of Ohio County is prime farmland. Prime farmland is scattered throughout the county, but the largest areas are in map units 1, 2, 4, and 6 on the general soil map. Many scattered areas of prime farmland are in the other map units.

A recent trend in land use in some parts of the county has been the conversion of some prime farmland to strip mines and industrial uses. The loss of prime farmland to other uses puts pressure on marginal lands, which generally are wet, more erodible, or difficult to cultivate and less productive than prime farmland.

The map units or soils in table 5 meet the soil requirement for prime farmland in Ohio County. On some soils included in the list, appropriate measures needed to overcome a hazard or limitation, such as flooding or wetness, are indicated in parentheses after the map unit name. The location of each map unit is shown on the detailed soil maps at the back of this publication. The extent of each map unit is given in table 4. The soil qualities that affect use and management are described in the section "Detailed Soil Map Units." This list does not constitute a recommendation for a particular land use.

Use and Management of the Soils

This soil survey is an inventory and evaluation of the soils in the survey area. It can be used to adjust land uses to the limitations and potentials of natural resources and the environment. Also, it can help avoid soil-related failures in land uses.

In preparing a soil survey, soil scientists, conservationists, engineers, and others collect extensive field data about the nature and behavior characteristics of the soils. They collect data on erosion, droughtiness, flooding, and other factors that affect various soil uses and management. Field experience and collected data on soil properties and performance are used as a basis for predicting soil behavior.

Information in this section can be used to plan the use and management of soils for crops and pasture; as woodland; as sites for buildings, sanitary facilities, highways and other transportation systems, and parks and other recreation facilities; and for wildlife habitat. It can be used to identify the potentials and limitations of each soil for specific land uses and to help prevent construction failures caused by unfavorable soil properties.

Planners and others using soil survey information can evaluate the effect of specific land uses on productivity and on the environment in all or part of the survey area. The survey can help planners to maintain or create a land use pattern that is in harmony with nature.

Contractors can use this survey to locate sources of sand and gravel, roadfill, and topsoil. They can use it to identify areas where bedrock, wetness, or very firm soil layers can cause difficulty in excavation.

Health officials, highway officials, engineers, and others may also find this survey useful. The survey can help them plan the safe disposal of wastes and locate sites for pavements, sidewalks, campgrounds, playgrounds, lawns, and trees and shrubs.

Crops, Pasture and Hayland

William H. Amos, Jr., agronomist, and Carl W. Hail, assistant state soil scientist, Soil Conservation Service, assisted in writing this section.

General management needed for crops and pasture and hayland is suggested in this section (fig. 15). The crops or pasture plants best suited to the soils, including some not commonly grown in the survey area, are identified; the system of land capability classification used by the Soil Conservation Service is explained; and the estimated yields of the main crops and hay and pasture plants are listed for each soil.

Planners of management systems for individual fields or farms should consider the detailed information given in the description of each soil under "Detailed Soil Map Units." Specific information can be obtained from the local office of the Soil Conservation Service or the Cooperative Extension Service.

Pasture and Hayland

A successful livestock program is dependent on a forage program that will supply large quantities of homegrown feeds of adequate quality. Such a program can furnish up to 78 percent of the feed for beef and 66 percent for dairy cattle.

In Ohio County about 56,000 acres are used for hay and pasture (fig. 16). About 36,000 acres needs reestablishment; a sizeable acreage needs improvement, brush control, and protection from overgrazing.

The soils in Ohio County vary widely in their capabilities and properties because of differences in depth to rock or limiting layers, internal drainage, ability to supply moisture, and many other properties. Grasses and legumes and grass-legume combinations vary widely in their ability to persist and produce on different soils. It is important to match the plants or mixture of plants to the different soils so that the greatest returns can be realized along with maximum soil and water conservation.

For the best use of nearly level to gently sloping, deep, well drained soils, the highest producing crops, such as corn, alfalfa, or a mixture of alfalfa-orchardgrass or alfalfa-timothy, are planted. Maintaining soils on steeper slopes in sod-forming grasses, such as tall fescue or bluegrass, minimizes soil erosion. Alfalfa is used with a cool-season grass on the soils that are at least 2 feet deep and well drained. On soils less than 2 feet deep, or not well drained, clover-grass mixtures or pure grass stands are used. Legumes can be established in grass-dominant sods through renovation.

Plants need to be adapted not only to the soil but also to the intended use *(5)*. Selected plants need to provide maximum quality and versatility in the forage program. Legumes generally produce higher quality feed than grasses, resulting in higher animal performance, if used to the maximum extent possible. Taller growing legumes, such as alfalfa and red clover, are more versatile than a legume, such as white clover, which is used primarily for

grazing. Grasses, such as orchardgrass, timothy, and tall fescue, are better adapted for hay and silage.

Tall fescue is an important cool-season grass suited to a wide range of soil conditions. It is used for pasture and hay. Growth from August to November is commonly permitted to accumulate in the field and is "stockpiled" for deferred grazing late in fall and in winter. Nitrogen fertilizer is one of the important keys for maximum production during the stockpiling period. Desired production levels determine the rates of application.

Renovation increases the yields of pasture and hay fields that have a good stand of grass. Renovation is the improvement of pasture and hay fields by partial destruction of the sod, and liming, fertilizing, and seeding to reestablish desirable forage plants *(6)*. Adding legumes to these grass fields provides high quality feed; legumes increase summer production and take nitrogen from the air. Under Kentucky growing conditions, alfalfa can fix 200 to 300 pounds of nitrogen per acre every year; red clover, 100 to 200 pounds; and Ladino clover, 100 to 150 pounds. An acre of Korean lespedeza, vetch, and other annual forage legumes can fix 75 to 100 pounds of nitrogen a year *(5)*.

Some important steps in successful renovation and management are:

- Graze or mow close before disking or disturbing the sod.
- Disturb 40 to 60 percent of the grass for sowing clovers and 80 to 100 percent for alfalfa. A disk, field cultivator, or field tiller can be used.
- Take soil tests and apply the needed lime, phosphate, and potash. Do not use nitrogen when renovating old grass fields as it increases grass competition to the legume seedlings.
- Prepare a smooth, firm seedbed and distribute the seed evenly over the area, covering the seed

Figure 15.—Pasture in the foreground on Frondorf-Wellston-Rosine silt loams, 12 to 20 percent slopes, eroded; corn in the background on Stendal silt loam, occasionally flooded.

Figure 16.—Fescue and clover pasture on gently sloping and sloping Wellston and Zanesville soils.

about 1/8 to 1/4 inch deep to assure a good seed-soil contact.

- Seed an adapted variety that has a high percent germination and inoculate with the proper nitrogen-fixing bacteria.
- Seed fescue, bluegrass, timothy, orchardgrass, ryegrass, and small grains for forages late in summer or early in fall. Alfalfa, red clover, white clover, and lespedeza generally are most successfully seeded in the spring.
- Keep renovated fields grazed short until livestock start biting on the young legumes, then remove livestock and allow legumes to become established.
- Control grazing and leave 2 to 3 inches of top growth on established grass-legume mixtures.
- Mow pastures as needed to remove grass seed heads and to control weeds and woody vegetation.
- Topdress annually with phosphate and potash according to soil tests, and add lime to maintain soil pH for the legume that is being grown.
- Check renovated fields for insect damage or disease.

For additional information on pasture and hayland management, contact the local office of the Soil Conservation Service or the Kentucky Cooperative Extensive Service.

Yields Per Acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 6. In any given year, yields may be

higher or lower than those indicated in the table because of variations in rainfall and other climatic factors.

The yields are based mainly on the experience and records of farmers, conservationists, and extension agents. Available yield data from nearby counties and results of field trials and demonstrations are also considered.

The management needed to obtain the indicated yields of the various crops depends on the kind of soil and the crop. Management can include drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate and timely tillage; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residue, barnyard manure, and green manure crops; and harvesting that insures the smallest possible loss.

The estimated yields reflect the productive capacity of each soil for each of the principal crops. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

Crops other than those shown in table 6 are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local office of the Soil Conservation Service or of the Cooperative Extension Service can provide information about the management and productivity of the soils for those crops.

Land Capability Classification

Land capability classification shows, in a general way, the suitability of soils for use as cropland. Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The criteria used in grouping the soils do not include major, and generally expensive, landforming that would change slope, depth, or other characteristics of the soils, nor do they include possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for rangeland, for woodland, and for engineering purposes.

In the capability system, soils are generally grouped at three levels: capability class, subclass, and unit. Only class and subclass are used in this survey. These levels are defined in the following paragraphs.

Capability classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class I soils have few limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants or that require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants or that require very careful management, or both.

Class V soils are not likely to erode, but they have other limitations, impractical to remove, that limit their use.

Class VI soils have severe limitations that make them generally unsuitable for cultivation.

Class VII soils have very severe limitations that make them unsuitable for cultivation.

Class VIII soils and miscellaneous areas have limitations that nearly preclude their use for commercial crop production.

Capability subclasses are soil groups within one class. They are designated by adding a small letter, *e, w, s,* or *c,* to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless a close-growing plant cover is maintained (fig. 17); *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is very cold or very dry.

There are no subclasses in class I because the soils of this class have few limitations. The soils in class V are subject to little or no erosion, but they have other limitations that restrict their use to pasture, rangeland, woodland, wildlife habitat, or recreation. Class V contains only the subclasses indicated by *w, s,* or *c*.

The acreage of soils in each capability class and subclass is shown in table 7. The capability classification of each map unit is given in the section "Detailed Soil Map Units," and in table 6.

Woodland Management and Productivity

Charles A. Foster, forester, Soil Conservation Service, assisted in writing this section.

Ohio County is in the Western Mesophytic Forest Region of Kentucky, a transitional area with oak trees dominating forest communities. About 195,000 acres, or 51 percent, of the county is commercial forest land. The dominant forest types are oak-hickory, 74 percent of the forest land; elm-ash-maple, 11 percent; maple-beech-birch, 5 percent; oak-pine, 5 percent; loblolly-shortleaf pine, 4 percent; and oak-gum, 1 percent *(9)*.

Woodland tracts in the soil survey area are mostly small private holdings of approximately 24 acres and are essentially unmanaged. Most of this soil has the

Figure 17.—Corn on soils in capability subclass IIw, and permanent vegetation on soils in capability subclasses IIIe and VIe.

capability of growing 50 cubic feet or more of wood per acre per year, but actual growth averages about 33 cubic feet. Several obstacles to management of private forest lands are that many landowners own woodland simply because it happens to be a part of the farm or tract, many stands are not well stocked with desirable trees of high quality, and many tracts are owned less than 10 years.

With proper management, tree growth, stocking, and quality can be improved. This involves removal of low quality trees in fully stocked and understocked stands of all sizes, as well as regeneration of sawtimber stands after harvest. Soil surveys are a useful management tool to identify Kentucky's more productive forest sites, soil limitations for management, and trees to favor or plant or both.

The wood-using industry of Ohio County consists of six commercial sawmills, one log and bolt mill, and two pallet mills. Products produced are dimension stock, rough lumber, chips, pallets, and cants. Several mills in adjacent counties also buy logs or standing trees from the survey area.

Table 8 can be used by woodland owners or forest managers in planning the use of soils for wood crops (fig. 18). Only those soils suitable for wood crops are listed. The table lists the ordination symbol (woodland suitability) for each soil. Soils assigned the same ordination symbol require the same general management and have about the same potential productivity.

The first part of the *ordination symbol*, a number, indicates the potential productivity of the soils for important trees. The number 1 indicates very high productivity; 2, high; 3, moderately high; 4, moderate; and 5, low. The second part of the symbol, a letter, indicates the major kind of soil limitation. The letter *x* indicates stoniness or rockiness; *w*, excessive water in or on the soil; *c*, clay in the upper part of the soil; and *r*, steep slopes. The letter *o* indicates that limitations or restrictions are insignificant. If a soil has more than one limitation, the priority is as follows: x, w, c, and r.

In table 8, *slight, moderate,* and *severe* indicate the degree of the major soil limitations to be considered in management.

Ratings of the *erosion hazard* indicate the risk of loss of soil in a well-managed woodland. The risk is *slight* if the expected soil loss is small, *moderate* if measures are needed to control erosion during logging and road construction, and *severe* if intensive management or special equipment and methods are needed to prevent excessive loss of soil.

Ratings of *equipment limitation* reflect the characteristics and conditions of the soil that restrict use of the equipment generally needed in woodland management or harvesting. A rating of *slight* indicates that use of equipment is not limited to a particular kind of equipment or time of year; *moderate* indicates a short seasonal limitation or a need for some modification in management or in equipment; and *severe* indicates a

Figure 18.—Young hardwood trees on Frondorf-Wellston-Rosine silt loams, 12 to 20 percent slopes, eroded.

seasonal limitation, a need for special equipment or management, or a hazard in the use of equipment.

Seedling mortality ratings indicate the degree to which the soil affects the mortality of tree seedlings. Plant competition is not considered in the ratings. The ratings apply to seedlings from good stock that are properly planted during a period of sufficient rainfall. A rating of *slight* indicates that the expected mortality is less than 25 percent; *moderate*, 25 to 50 percent; and *severe*, more than 50 percent.

Ratings of *plant competition* indicate the degree to which undesirable plants are expected to invade where there are openings in the tree canopy. The invading plants compete with native plants or planted seedlings. A rating of *slight* indicates little or no competition from other plants; *moderate* indicates that plant competition is expected to hinder the development of a fully stocked stand of desirable trees; *severe* indicates that plant competition is expected to prevent the establishment of a desirable stand unless the site is intensively prepared, weeded, or otherwise managed to control undesirable plants.

The *potential productivity* of merchantable or *common trees* on a soil is expressed as a *site index*. This index is the average height, in feet, that dominant and codominant trees of a given species attain in a specified number of years. The site index applies to fully stocked, even-aged, unmanaged stands. Commonly grown trees are those that woodland managers generally favor in intermediate or improvement cuttings. They are selected on the basis of growth rate, quality, value, and marketability.

Trees to plant are those that are suited to the soils and to commercial wood production.

Recreation

In table 9, the soils of the survey area are rated according to the limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the

size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewerlines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation are also important. Soils subject to flooding are limited for recreational use by the duration and intensity of flooding and the season when flooding occurs. In planning recreation facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

In table 9, the degree of soil limitation is expressed as slight, moderate, or severe. *Slight* means that soil properties are generally favorable and that limitations are minor and easily overcome. *Moderate* means that limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 9 can be supplemented by other information in this survey, for example, interpretations for septic tank absorption fields in table 12 and interpretations for dwellings without basements and for local roads and streets in table 11.

Camp areas require site preparation such as shaping and leveling the tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils have gentle slopes and are not wet or subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing campsites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes, stones, or boulders that increase the cost of shaping sites or of building access roads and parking areas.

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is free of stones and boulders, is firm after rains, and is not dusty when dry. If grading is needed, the depth of the soil over bedrock or a hardpan should be considered.

Paths and trails for hiking and horseback riding should require little or no cutting and filling. The best soils are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once a year during the period of use. They have moderate slopes and few or no stones or boulders on the surface.

Golf fairways are subject to heavy foot traffic and some light vehicular traffic. Cutting or filling may be required. The best soils for use as golf fairways are firm when wet, are not dusty when dry, and are not subject to prolonged flooding during the period of use. They have moderate slopes and no stones or boulders on the surface. The suitability of the soil for tees or greens is not considered in rating the soils.

Wildlife Habitat

William H. Casey, biologist, Soil Conservation Service, assisted in writing this section.

The wildlife population of Ohio County consists of an estimated 42 species of mammals, 64 species of reptiles and amphibians, and 102 species of birds that are either summer or year-round residents. Many of the more than 200 other kinds of birds that visit Kentucky each year can be found in the county in one season or another.

The kinds of wildlife most important at present are those that furnish recreation in the form of sport hunting, economic gain in the form of commercial trapping, and aesthetic enjoyment in the form of observing or photographing. Also of concern are those species that are in danger of extinction.

In Ohio County wildlife most often hunted are cottontail rabbit, bobwhite quail, gray squirrel, mourning dove, raccoon, red fox, and white-tailed deer. Trapping effort is concentrated upon raccoon, mink, and muskrat. Birdwatchers and photographers are especially interested in rare or unusual species that are seldom seen or difficult to approach. The Indiana bat, a mammal that has been declared endangered by the U.S. Fish and Wildlife Service and is protected by the Endangered Species Act of 1973, probably passes through the county on its migrations, and a few may remain in the county during the summer.

Soils affect the kind and amount of vegetation that is available to wildlife as food and cover. They also affect the construction of water impoundments. The kind and abundance of wildlife depend largely on the amount and distribution of food, cover, and water. Wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by promoting the natural establishment of desirable plants *(3)*.

In table 10, the soils in the survey area are rated according to their potential for providing habitat for various kinds of wildlife. This information can be used in planning parks, wildlife refuges, nature study areas, and other developments for wildlife; in selecting soils that are suitable for establishing, improving, or maintaining specific elements of wildlife habitat; and in determining the intensity of management needed for each element of the habitat.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* indicates that the element or

kind of habitat is easily established, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected. A rating of *fair* indicates that the element or kind of habitat can be established, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* indicates that limitations are severe for the designated element or kind of habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* indicates that restrictions for the element or kind of habitat are very severe and that unsatisfactory results can be expected. Creating, improving, or maintaining habitat is impractical or impossible.

The elements of wildlife habitat are described in the following paragraphs.

Grain and seed crops are domestic grains and seed-producing herbaceous plants. Soil properties and features that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are corn, wheat, oats, and soybeans.

Grasses and legumes are domestic perennial grasses and herbaceous legumes. Soil properties and features that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flood hazard, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are fescue, bluegrass, orchardgrass, clover, lespedeza, and alfalfa.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds. Soil properties and features that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are bluestem, goldenrod, and beggarweed.

Hardwood trees and woody understory produce nuts or other fruit, buds, catkins, twigs, bark, and foliage. Soil properties and features that affect the growth of hardwood trees and shrubs are depth of the root zone, the available water capacity, and wetness. Examples of these plants are oak, poplar, cherry, sweetgum, apple, hawthorn, dogwood, and hickory. Examples of fruit-producing shrubs that are suitable for planting on soils rated *good* are Russian-olive, silky dogwood, autumn-olive, and crabapple.

Coniferous plants furnish browse and seeds. Soil properties and features that affect the growth of coniferous trees, shrubs, and ground cover are depth of the root zone, available water capacity, and wetness. Examples of coniferous plants are pine and cedar.

Wetland plants are annual and perennial, wild herbaceous plants that grow on moist or wet sites. Submerged or floating aquatic plants are excluded. Soil properties and features affecting wetland plants are texture of the surface layer, wetness, reaction, slope, and surface stoniness. Examples of wetland plants are smartweed, wild millet, rushes, sedges, and reeds.

Shallow water areas have an average depth of less than 5 feet. Some are naturally wet areas. Others are created by dams, levees, or other water-control structures. Soil properties and features affecting shallow water areas are depth to bedrock, wetness, surface stoniness, slope, and permeability. Examples of shallow water areas are marshes, waterfowl feeding areas, and ponds.

The habitat for various kinds of wildlife is described in the following paragraphs.

Habitat for openland wildlife consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. The wildlife attracted to these areas include bobwhite quail, meadowlark, field sparrow, cottontail, and red fox.

Habitat for woodland wildlife consists of areas of deciduous plants or coniferous plants or both and associated grasses, legumes, and wild herbaceous plants. Wildlife attracted to these areas include wild turkey, woodcock, thrushes, woodpeckers, squirrels, gray fox, raccoon, and deer.

Habitat for wetland wildlife consists of open, marshy or swampy shallow water areas. Some of the wildlife attracted to such areas are ducks, geese, herons, shore birds, muskrat, mink, and beaver.

Engineering

Billy H. Vivrette, area engineer, assisted in writing this section.

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. The ratings are given in the following tables: Building site development, Sanitary facilities, Construction materials, and Water management. The ratings are based on observed performance of the soils and on the estimated data and test data in the "Soil Properties" section.

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 or 6 feet. Because of the map scale, small areas of different soils

may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this section. Local ordinances and regulations must be considered in planning, in site selection, and in design.

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock within 5 to 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to: evaluate the potential of areas for residential, commercial, industrial, and recreational uses; make preliminary estimates of construction conditions; evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; plan detailed onsite investigations of soils and geology; locate potential sources of gravel, sand, earthfill, and topsoil; plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

The information in the tables, along with the soil maps, the soil descriptions, and other data provided in this survey can be used to make additional interpretations.

Some of the terms used in this soil survey have a special meaning in soil science and are defined in the Glossary.

Building Site Development

Table 11 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, local roads and streets, and lawns and landscaping. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, utility lines, open ditches, and other purposes. The ratings are based on soil properties, site features, and observed performance of the soils. The ease of digging, filling, and compacting is affected by the depth to bedrock or a very firm dense layer; stone content; soil texture; and slope. The time of the year that excavations can be made is affected by the depth to a seasonal high water table and the susceptibility of the soil to flooding. The resistance of the excavation walls or banks to sloughing or caving is affected by soil texture and the depth to the water table.

Dwellings and small commercial buildings are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made for small commercial buildings without basements, for dwellings with basements, and for dwellings without basements. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding (fig. 19), shrink-swell potential, and organic layers can cause the movement of footings. A high water table, depth to bedrock, large stones, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 to 6 feet are not considered.

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material, a base of gravel, crushed rock, or stabilized soil material, and a flexible or rigid surface. Cuts and fills are generally limited to less than 6 feet. The ratings are based on soil properties, site features, and observed performance of the soils. Depth to bedrock or to a high water table, flooding, large stones, and slope affect the ease of excavating and grading. Soil strength (as inferred from the engineering classification of the soil), shrink-swell potential, and depth to a high water table affect the traffic-supporting capacity.

Lawns and landscaping require soils on which turf and ornamental trees and shrubs can be established and maintained. The ratings are based on soil properties, site features, and observed performance of the soils. Soil reaction, a high water table, depth to bedrock, and the available water capacity in the upper 40 inches affect plant growth. Flooding, wetness, slope, stoniness, and the amount of sand, clay, or organic matter in the surface layer affect trafficability after vegetation is established.

Figure 19.—Soils on the flood plain have a severe limitation as sites for buildings. Most flooding is late in winter or early in spring.

Sanitary Facilities

Table 12 shows the degree and the kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

Table 12 also shows the suitability of the soils for use as daily cover for landfills. A rating of *good* indicates that soil properties and site features are favorable for the use and that good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 72 inches is evaluated. The ratings are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, depth to bedrock, and flooding affect absorption of the effluent. Large stones and bedrock or a cemented pan interfere with installation.

Unsatisfactory performance of septic tank absorption fields, including excessively slow absorption of effluent,

surfacing of effluent, and hillside seepage, can affect public health. Ground water can be polluted if highly permeable sand and gravel or fractured bedrock is less than 4 feet below the base of the absorption field, if slope is excessive, or if the water table is near the surface. There must be unsaturated soil material beneath the absorption field to filter the effluent effectively. Many local ordinances require that this material be of a certain thickness.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Lagoons generally are designed to hold the sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water.

Table 12 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, a high water table, depth to bedrock or pan, flooding, large stones, and content of organic matter.

Excessive seepage due to rapid permeability of the soil or a water table that is high enough to raise the level of sewage in the lagoon causes a lagoon to function unsatisfactorily. Pollution results if seepage is excessive or if floodwater overtops the lagoon. A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope and bedrock can cause construction problems, and large stones can hinder compaction of the lagoon floor.

Sanitary landfills are areas where solid waste is disposed of by burying it in soil. There are two types of landfill—trench and area. In a trench landfill, the waste is placed in a trench. It is spread, compacted, and covered daily with a thin layer of soil excavated at the site. In an area landfill, the waste is placed in successive layers on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil from a source away from the site.

Both types of landfill must be able to bear heavy vehicular traffic. Both types involve a risk of ground water pollution. Ease of excavation and revegetation needs to be considered.

The ratings in table 12 are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock or pan, a high water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, highly organic layers, and soil reaction affect trench type landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

Daily cover for landfill is the soil material that is used to cover compacted solid waste in an area type sanitary landfill. The soil material is obtained offsite, transported to the landfill, and spread over the waste.

Soil texture, wetness, coarse fragments, and slope affect the ease of removing and spreading the material during wet and dry periods. Loamy or silty soils that are free of large stones or excess gravel are the best cover for a landfill. Clayey soils are sticky or cloddy and are difficult to spread; sandy soils are subject to soil blowing.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over bedrock or the water table to permit revegetation. The soil material used as final cover for a landfill should be suitable for plants. The surface layer generally has the best workability, more organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

Construction Materials

Table 13 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good, fair,* or *poor* as a source of roadfill and topsoil. They are rated as a probable or improbable source of sand and gravel. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 or 6 feet.

Roadfill is soil material that is excavated in one place and used in road embankments in another place. In this table, the soils are rated as a source of roadfill for low embankments, generally less than 6 feet high and less exacting in design than higher embankments.

The ratings are for the soil material below the surface layer to a depth of 5 or 6 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. The table showing engineering index properties provides detailed information about each soil layer. This information can help determine the suitability of each layer for use as roadfill. The performance of soil after it is stabilized with lime or cement is not considered in the ratings.

The ratings are based on soil properties, site features, and observed performance of the soils. The thickness of suitable material is a major consideration. The ease of excavation is affected by large stones, a high water table, and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the engineering classification of the soil) and shrink-swell potential.

Soils rated *good* contain significant amounts of sand or gravel or both. They have at least 5 feet of suitable material, low shrink-swell potential, few cobbles and stones, and slopes of 15 percent or less. Depth to the water table is more than 3 feet. Soils rated *fair* are more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have moderate shrink-swell potential, slopes of 15 to 25 percent, or many stones. Depth to the water table is 1 to 3 feet. Soils rated *poor* have a plasticity index of more than 10, a high shrink-swell potential, many stones, or slopes of more than 25 percent. They are wet, and the depth to the water table is less than 1 foot. They may have layers of suitable material, but the material is less than 3 feet thick.

Sand and gravel are natural aggregates suitable for commercial use with a minimum of processing. Sand and gravel are used in many kinds of construction. Specifications for each use vary widely. In table 13, only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

The properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the engineering classification of the soil), the thickness of suitable material, and the content of rock fragments. Kinds of rock, acidity, and stratification are given in the soil series descriptions. Gradation of grain sizes is given in the table on engineering index properties.

A soil rated as a probable source has a layer of clean sand or gravel or a layer of sand or gravel that is up to 12 percent silty fines. This material must be at least 3 feet thick and less than 50 percent, by weight, large stones. All other soils are rated as an improbable source. Coarse fragments of soft bedrock, such as shale and siltstone, are not considered to be sand and gravel.

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area.

Plant growth is affected by toxic material and by such properties as soil reaction, available water capacity, and fertility. The ease of excavating, loading, and spreading is affected by rock fragments, slope, a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, a water table, rock fragments, bedrock, and toxic material.

Soils rated *good* have friable, loamy material to a depth of at least 40 inches. They are free of stones and cobbles, have little or no gravel, and have slopes of less than 8 percent. They are low in content of soluble salts, are naturally fertile or respond well to fertilizer, and are not so wet that excavation is difficult.

Soils rated *fair* are sandy soils, loamy soils that have a relatively high content of clay, soils that have only 20 to 40 inches of suitable material, soils that have an appreciable amount of gravel, stones, or soluble salts, or soils that have slopes of 8 to 15 percent. The soils are not so wet that excavation is difficult.

Soils rated *poor* are very sandy or clayey, have less than 20 inches of suitable material, have a large amount of gravel, stones, or soluble salts, have slopes of more than 15 percent, or have a seasonal water table at or near the surface.

The surface layer of most soils is generally preferred for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and releases a variety of plant-available nutrients as it decomposes.

Water Management

Table 14 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas; embankments, dikes, and levees. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

This table also gives the restrictive features that affect each soil for drainage, terraces and diversions, and grassed waterways.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches. The seepage potential is determined by the permeability of the soil and the depth to fractured bedrock or other permeable material. Excessive slope can affect the storage capacity of the reservoir area.

Embankments, dikes, and levees are raised structures of soil material, generally less than 20 feet high, constructed to impound water or to protect land against overflow. In this table, the soils are rated as a source of material for embankment fill. The ratings apply to the soil material below the surface layer to a depth of about 5 feet. It is assumed that soil layers will be uniformly mixed and compacted during construction.

The ratings do not indicate the ability of the natural soil to support an embankment. Soil properties to a depth greater than the height of the embankment can affect performance and safety of the embankment. Generally, deeper onsite investigation is needed to determine these properties.

Soil material in embankments must be resistant to seepage, piping, and erosion and have favorable

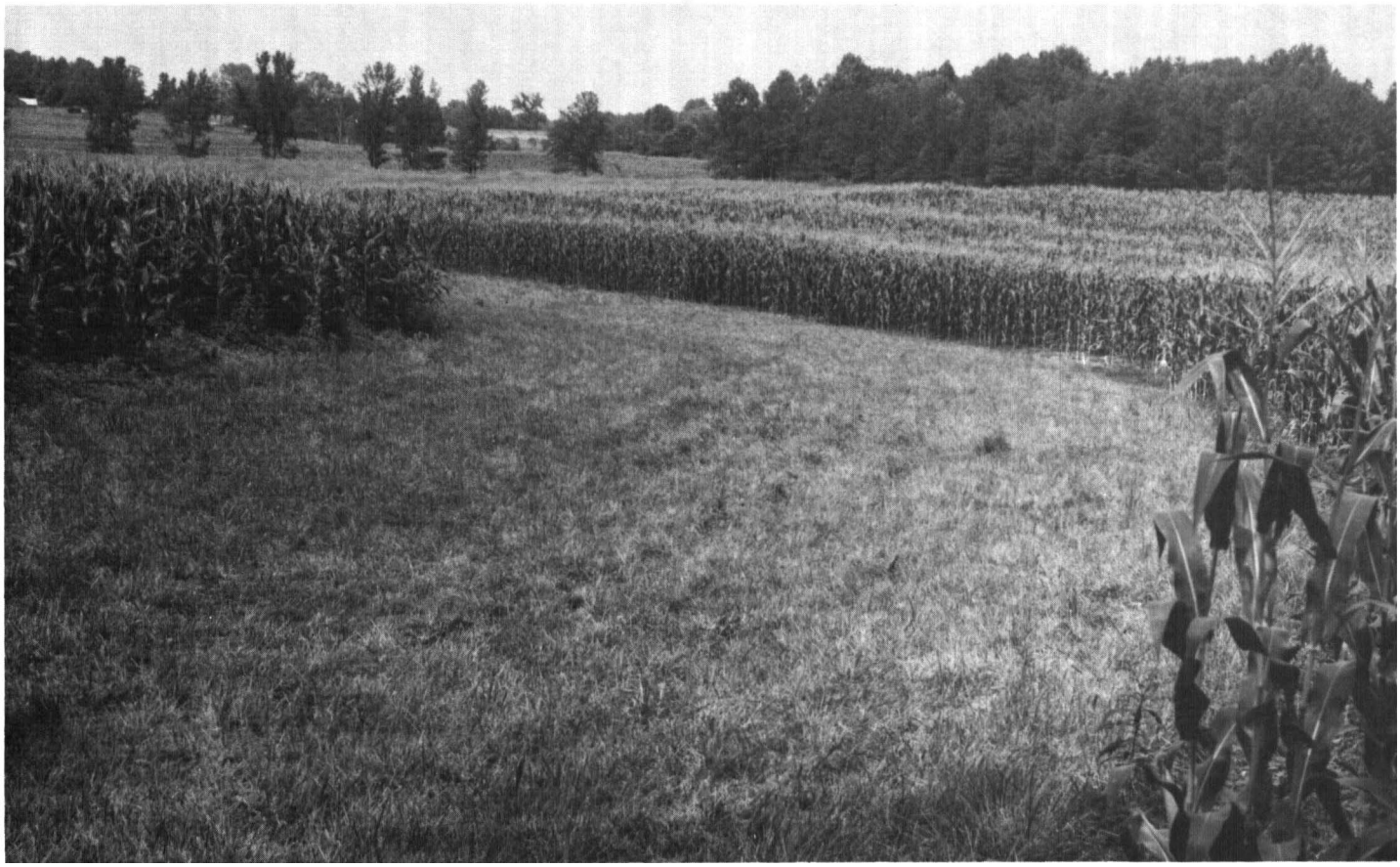


Figure 20.—Grassed waterway and corn on Sadler silt loam, 2 to 6 percent slopes, eroded.

compaction characteristics. Unfavorable features include less than 5 feet of suitable material and a high content of stones, boulders, or organic matter. A high water table affects the amount of usable material. It also affects trafficability.

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to bedrock or to other layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; susceptibility to flooding; subsidence of organic layers; and potential frost action. Excavating and grading and the stability of ditchbanks are affected by depth to bedrock, large stones, slope, and the hazard of cutbanks caving. The productivity of the soil after drainage is adversely affected by extreme acidity or by toxic substances in the root zone, such as salts, sodium, or sulfur. Availability of drainage outlets is not considered in the ratings.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to reduce erosion and conserve moisture by intercepting runoff. Slope, wetness, large stones, and depth to bedrock or to a cemented pan affect the construction of terraces and diversions. A restricted rooting depth, a severe hazard of wind or water erosion, an excessively coarse texture, and restricted permeability adversely affect maintenance.

Grassed waterways are natural or constructed channels (fig. 20), generally broad and shallow, that conduct surface water to outlets at a nonerosive velocity. Large stones, wetness, slope, and depth to bedrock or to a cemented pan affect the construction of grassed waterways. A hazard of erosion, low available water capacity, restricted rooting depth, and restricted permeability adversely affect the growth and maintenance of the grass after construction of the waterway.

Soil Properties

Data relating to soil properties are collected during the course of the soil survey. The data and the estimates of soil and water features, listed in tables, are explained on the following pages.

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics. These results are reported in table 21.

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the survey area, and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help characterize key soils.

The estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classifications, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

Engineering Index Properties

Table 15 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each soil series under "Soil Series and Their Morphology."

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is as much as 15 percent, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the Glossary.

Classification of the soils is determined according to the Unified soil classification system *(2)* and the system adopted by the American Association of State Highway and Transportation Officials *(1)*.

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as PT. Soils exhibiting engineering properties of two groups can have a dual classification, for example, SP-SM.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20, or higher, for the poorest. The AASHTO classification for soils tested, with group index numbers in parentheses, is given in table 21.

Rock fragments larger than 3 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an ovendry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area, or from nearby areas, and on field examination.

Physical and Chemical Properties

Table 16 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Clay as a soil separate, or component, consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this table, the estimated clay content of each major soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The amount and kind of clay greatly affect the fertility and physical condition of the soil. They influence the soil's absorption of cations, moisture retention, shrink-swell potential, permeability, plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earthmoving operations.

Moist bulk density is the weight of soil (ovendry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at 1/3 bar moisture tension. Weight is determined after drying the soil at 105 degrees C. In this table, the estimated moist bulk density of each major soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. A bulk density of more than 1.6 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

Permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of downward movement of water when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems, septic tank absorption fields, and construction where the rate of water movement under saturated conditions affects behavior.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage in each major soil layer is stated in inches of water per inch of soil. The capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Soil reaction is a measure of acidity or alkalinity and is expressed as a range in pH values. The range in pH of each major horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Shrink-swell potential is the potential for volume change in a soil with a loss or gain in moisture. Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on measurements of similar soils.

If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to buildings, roads, and other structures. Special design is often needed.

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The change is based on the soil fraction less than 2 millimeters in diameter. The classes are *low*, a change of less than 3 percent; *moderate*, 3 to 6 percent; and *high*, more than 6 percent. *Very high*, greater than 9 percent, is sometimes used.

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average annual rate of soil loss by sheet and rill erosion. Losses are expressed in tons per acre per year. These estimates are based primarily on percentage of silt, sand, and organic matter (up to 4 percent) and on soil structure and permeability. Values of K range from 0.02 to 0.69. The higher the value, the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind or water that can occur over a sustained period without affecting crop productivity. The rate is expressed in tons per acre per year.

Organic matter is the plant and animal residue in the soil at various stages of decomposition.

In table 16, the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter of a soil can be maintained or increased by returning crop residue to the soil. Organic matter affects the available water capacity, infiltration rate, and tilth. It is a source of nitrogen and other nutrients for crops.

Soil and Water Features

Table 17 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils are assigned to one of four groups. They are grouped according to the intake of water when the soils are thoroughly wet and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

Flooding, the temporary covering of the soil surface by flowing water, is caused by overflowing streams, by runoff from adjacent slopes, or by inflow from high tides. Shallow water standing or flowing for short periods after rainfall or snowmelt is not considered flooding. Standing water in swamps and marshes or in a closed depreciation is considered ponding.

Table 17 gives the frequency and duration of flooding and the time of year when flooding is most likely to occur.

Frequency, duration, and probable dates of occurrence are estimated. Frequency generally is expressed as *none, rare, occasional,* or *frequent. None* means that flooding is not probable. *Rare* means that flooding is unlikely but possible under unusual weather conditions (there is a near 0 to 5 percent chance of flooding in any year). *Occasional* means that flooding occurs infrequently under normal weather conditions (there is a 5 to 50 percent chance of flooding in any year). *Frequent* means that flooding occurs often under normal weather conditions (there is more than a 50 percent chance of flooding in any year). *common* is used when classification as occasional or frequent does not affect interpretations. Duration is expressed as *very brief* (less than 2 days), *brief* (2 to 7 days), *long* (7 days to 1 month), and *very long* (more than 1 month). The time of year that floods are most likely to occur is expressed in months. November-May, for example, means that flooding can occur during the period November through May. About two-thirds to three-fourths of all flooding occurs during the stated period.

The information on flooding is based on evidence in the soil profile, namely, thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and absence of distinctive horizons, which are characteristic of soils that are not subject to flooding.

Also considered are local information about the extent and levels of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. The depth to a seasonal high water table applies to undrained soils. The estimates are based mainly on the evidence of a saturated zone, namely grayish colors or mottles in the soil. Indicated in table 17 are the depth to the seasonal high water table; the kind of water table, that is, *perched* or *apparent;* and the months of the year that the water table commonly is highest. A water table that is seasonally high for less than 1 month is not indicated in table 17.

An *apparent* water table is a thick zone of free water in the soil. It is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil. A *perched* water table is water standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

The two numbers in the "High water table-Depth" column indicate the normal range in depth to a saturated zone. Depth is given to the nearest half foot. The first numeral in the range indicates the highest water level. A plus sign preceding the range in depth indicates that the water table is above the surface of the soil. "More than 6.0" indicates that the water table is below a depth of 6 feet or that the water table exists for less than a month.

Depth to bedrock is given if bedrock is within a depth of 5 feet. The depth is based on many soil borings and on observations during soil mapping. The rock is specified as either soft or hard. If the rock is soft or fractured, excavations can be made with trenching machines, backhoes, or small rippers. If the rock is hard or massive, blasting or special equipment generally is needed for excavation.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors creates a severely corrosive environment. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low*, *moderate*, or *high*, is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion is also expressed as *low*, *moderate*, or *high*. It is based on soil texture, acidity, and the amount of sulfates in the saturation extract.

Physical and Chemical Analyses and Mineralogy of Selected Soils

The results of physical analysis of several typical pedons in the survey area are given in table 18 and the results of chemical analysis in table 19. The data are for soils sampled at carefully selected sites. The pedons are typical of the series and are described in the section "Soil Series and Their Morphology." Soil samples were analyzed by the Kentucky Agricultural Experiment Station.

The mineralogy of selected horizons was determined by the Soil Conservation Service, National Soil Survey Laboratory, and the results are given in table 20. Mineralogy was also determined on the sample from Morristown shaly silt loam (78KY-183-50) by X-ray diffraction and differential thermal analysis. By X-ray the relative amounts of kaolinite and mica were moderate, and there were traces of vermiculite and geothite. Differential thermal analysis showed that the sample contained 12 percent kaolinite.

Most determinations, except those for grain-size analysis and bulk density, were made on soil material smaller than 2 millimeters in diameter. Measurements reported as percent or quantity of unit weight were calculated on an oven-dry basis. The methods used in obtaining the data are indicated in the list that follows. The codes in parentheses refer to published methods *(16)*.

Coarse materials—(2-75 mm fraction) weight estimates of the percentages of all materials less than 75 mm (3B1).
Sand—(0.05-2.0 mm fraction) weight percentages of materials less than 2 mm (3A1).
Silt—(0.002-0.05 mm fraction) pipette extraction, weight percentages of all materials less than 2 mm (3A1).
Clay—(fraction less than 0.002 mm) pipette extraction, weight percentages of materials less than 2 mm (3A1).
Organic carbon—dichromate, ferric sulfate titration (6A1a).
Extractable cations—ammonium acetate pH 7.0, uncorrected; calcium (6N2), magnesium (602), sodium (6P2), potassium (6Q2).
Extractable acidity—barium chloride-triethanolamine I (6H1a).
Cation-exchange capacity—ammonium acetate, pH 7.0 (5A1a).
Cation-exchange capacity—sum of cations (5A3a).
Cation-exchange capacity—ammonium acetate, pH 7.0 (5A6a).
Base saturation—sum of cations, TEA, pH 8.2 (5C3).
Reaction (pH)—1:1 water dilution (8C1a).
Reaction (pH)—potassium chloride (8C1c).
Aluminum—potassium chloride extraction (6G).
Available phosphorus—procedure (656) Kentucky Agricultural Station.
Field sampling—site selection (1A1).
Field sampling—soil sampling (1A2).
Laboratory preparation—standard (air dry) material (1B1).
Particles—(specified size) 2 mm (2A2).
Particles—less than 2 mm (2A1).
Data sheet symbols—(2B).
Particles—greater than 2 mm by field or laboratory weighing (3B1a).
Extractable bases—(5B1a).
Exchangeable acidity—(H+ A1) method of Yuan procedure 67-3.52, part 2, methods of analysis, ASA, 1965.
Calcium carbonate equivalent—procedure (23b) USDA handbook 60, USDA salinity laboratory 1954 (6N7).
X-ray diffraction—(7A2B).
Differential thermal analysis—(7A3).
Total resistant minerals—(7B1A).

Engineering Index Test Data

Table 21 shows laboratory test data for several pedons sampled at carefully selected sites in the survey area. The pedons are typical of the series and are described in the section "Soil Series and Their Morphology." The soil samples were tested by Soil

Mechanics Laboratory, South National Technical Center, Fort Worth, Texas.

The testing methods generally are those of the American Association of State Highway and Transportation Officials (AASHTO) or the American Society for Testing and Materials (ASTM).

The tests and methods are: AASHTO classification—M 145 (AASHTO), D 3282 (ASTM); Unified classification—D 2487 (ASTM); Mechanical analysis—T 88 (AASHTO), D 2217 (ASTM); Liquid limit—T 89 (AASHTO), D 423 (ASTM); Plasticity index—T 90 (AASHTO), D 424 (ASTM); Moisture density, Method A—T 99 (AASHTO), D 698 (ASTM).

Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories *(13)*. Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or on laboratory measurements. Table 22 shows the classification of the soils in the survey area. The categories are defined in the following paragraphs.

ORDER. Ten soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol*. An example is Alfisol.

SUBORDER. Each order is divided into suborders, primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Udalf (*Ud*, meaning udic moisture regime, plus *alf*, from Alfisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Hapludalfs (*Hapl*, meaning minimal horizonation, plus *udalf*, the suborder of the Alfisols that have an udic moisture regime).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that typifies the great group. An example is Typic Hapludalfs.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Mostly the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineral content, temperature regime, depth of the root zone, consistence, moisture equivalent, slope, and permanent cracks. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is fine-loamy, mixed, nonacid, mesic Typic Hapludalfs.

SERIES. The series consists of soils that have similar horizons in their profile. The horizons are similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. There can be some variation in the texture of the surface layer or of the substratum within a series.

Soil Series and Their Morphology

In this section, each soil series recognized in the survey area is described. The descriptions are arranged in alphabetic order.

Characteristics of the soil and the material in which it formed are identified for each series. The soil is compared with similar soils and with nearby soils of other series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the *Soil Survey Manual (15)*. Many of the technical terms used in the descriptions are defined in *Soil Taxonomy (13)*. Unless otherwise stated, colors in the descriptions are for moist soil. Following the pedon description is the range of important characteristics of the soils in the series.

The map units of each soil series are described in the section "Detailed Soil Map Units."

Bethesda Series

The Bethesda series consists of deep, well drained soils that have moderately slow permeability. They formed in material that has been moved in the surface mining of coal. The material is soil and broken and crushed pieces of bedrock that were above the coal. Slope ranges from 2 to 70 percent.

Bethesda soils are associated with Fairpoint, Frondorf, Morristown, Rosine, Wellston, and Zanesville soils. Fairpoint and Morristown soils are less acid, and Morristown soils are calcareous. The Frondorf, Rosine, and Zanesville soils are not as deep to bedrock, contain

fewer coarse fragments, and have a more developed profile than the Bethesda soils.

Typical pedon of Bethesda very channery loam, in an area of Bethesda, Fairpoint, and Morristown soils, 20 to 70 percent slopes; 5 miles east of Beaver Dam, 1 mile south of U.S. Highway 62 and Horton, on soil map sheet 39, east-west 1,690,500 feet and north-south 389,500 feet by Kentucky grid coordinates:

Ap—0 to 6 inches; dark gray (5Y 4/1) very channery loam; weak fine granular structure; friable; few fine roots; 55 percent shale fragments 1/8 inch to 3 inches across; extremely acid; clear smooth boundary.

C1—6 to 21 inches; grayish brown (2.5Y 5/2) very gravelly loam; many fine distinct yellowish brown (10YR 5/6) mottles; massive; friable; 50 percent fragments, mostly sandstone, 1/8 inch to 4 inches across; extremely acid; gradual wavy boundary.

C2—21 to 40 inches; grayish brown (2.5Y 5/2) very channery loam; common fine distinct yellowish brown (10YR 5/6) mottles; massive; firm; 55 percent fragments, mostly sandstone, 1/8 inch to 4 inches across; extremely acid; gradual smooth boundary.

C3—40 to 60 inches; grayish brown (2.5Y 5/2) very channery silty clay loam; common fine distinct yellowish brown (10YR 5/6) mottles; massive; friable; 30 percent sandstone and 20 percent siltstone and other fragments mostly 1/8 inch to 10 inches across; extremely acid.

The thickness of the material is more than 6 feet and is 60 to 100 feet in most places. Reaction ranges from strongly acid to extremely acid throughout except for the surface layer in areas that have been limed. Content of rock fragments ranges from 35 to 65 percent throughout except for pedons covered with topsoil. Rock fragments include shale, siltstone, sandstone, and coal. Most fragments of shale are 1/8 to 1/2 inch thick and 1 inch to 8 inches long. Most fragments of sandstone and siltstone range from 1/4 inch to 8 inches in length, but a few pieces of sandstone are as large as 6 feet in diameter.

Soils that have been covered with topsoil have an A or Ap horizon of natural soil material that has hue of 7.5YR or 10YR, value of 3 to 6, and chroma of 1 to 6. The horizon is 4 to 12 inches thick.

The C horizon has dominant colors in hue of 10YR, 2.5Y, and 5Y, value of 3 to 5, and chroma of 1 to 4. Mottles are in hue of 10YR to 7.5YR, value of 4 or 5, and chroma of 4 to 8. Texture is shaly, very shaly, gravelly, very gravelly, or channery phases of loam, silty clay loam, clay loam, or silt loam.

Bonnie Series

The Bonnie series consists of deep, poorly drained soils that have moderate permeability. They formed in recent alluvium, have a seasonal high water table, and are subject to flooding. Bonnie soils are on flood plains in valleys adjacent to uplands throughout the survey area. Slope is mostly less than 2 percent.

Bonnie soils are associated with Cuba, Karnak, Melvin, Steff, and Stendal soils. The Cuba, Steff, and Stendal soils are better drained and have a lower percentage of gray colors in the subsoil than Bonnie soils. Melvin and Karnak soils are similar in drainage to the Bonnie soils, but they are less acid. Karnak soils have more clay in the subsoil.

Typical pedon of Bonnie silt loam, occasionally flooded; 0.5 mile north of Ralph on a county road, 0.5 mile northeast of the intersection of Carter ditch and the county road, 100 feet south of Carter ditch on soil map sheet 6, east-west 1,686,000 feet and north-south 473,000 feet by Kentucky grid coordinates:

Ap—0 to 6 inches; grayish brown (10YR 5/2) silt loam; few fine faint light brownish gray mottles and few fine distinct yellowish brown (10YR 5/6) mottles; weak medium granular structure; very friable; many fine roots; many pieces of organic matter; strongly acid; clear smooth boundary.

Bg1—6 to 18 inches; light gray (10YR 7/2) silt loam; many fine and medium distinct yellowish brown (10YR 5/6) mottles; weak coarse subangular blocky structure; very friable; common fine roots; few pieces of organic matter; very strongly acid; gradual wavy boundary.

Bg2—18 to 40 inches; light gray (10YR 7/2) silt loam; common coarse distinct yellowish brown (10YR 5/6, 5/8) mottles; weak coarse subangular blocky structure; very friable; few fine roots; very strongly acid; gradual wavy boundary.

Cg—40 to 60 inches; light gray (10YR 7/2) silt loam; common medium distinct yellowish brown (10YR 5/6) mottles; massive; very friable; very strongly acid.

The thickness of the solum ranges from 30 to 50 inches. Depth to bedrock is more than 60 inches. Reaction is very strongly acid or strongly acid throughout except in areas that have been limed.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 1 to 3.

The Bg horizon has dominant colors in hue of 10YR and 2.5Y, value of 4 to 7, and chroma of 1 or 2. Mottles are few to many and have hue of 7.5YR and 10YR, value of 4 to 6, and chroma of 3 to 6. The structure is medium or coarse subangular blocky or is fine granular.

The Cg horizon has dominant colors in hue of 10YR and 2.5Y, value of 4 to 7, and chroma of 1 or 2. Mottles have hue of 7.5YR and 10YR, value of 4 to 6, and chroma of 3 to 6.

Calloway Series

The Calloway series consists of deep, somewhat poorly drained soils that have slow permeability. They formed in loess on uplands and have a fragipan. Slope is mostly from 0 to 2 percent but ranges up to 3 percent.

Calloway soils are associated with Henshaw, Hosmer, Sadler, Weinbach, and Zanesville soils. Henshaw and Weinbach soils, which are on stream terraces, are similar in drainage to Calloway soils. Henshaw soils do not have a fragipan. Weinbach soils are underlain by stratified alluvial sediment. Hosmer, Sadler, and Zanesville soils are in similar positions as the Calloway soils, but they are better drained and do not have gray in the upper part of the subsoil.

Typical pedon of Calloway silt loam; 2 miles south of Hartford, 0.5 mile east of Kentucky Highway 69, and 100 feet north of Kentucky Highway 273, on soil map sheet 37, east-west 1,659,000 feet and north-south 398,500 feet by Kentucky grid coordinates:

Ap—0 to 8 inches; brown (10YR 4/3) silt loam; weak fine granular structure; very friable; common fine roots; slightly acid; clear smooth boundary.

Bw—8 to 22 inches; brown (10YR 5/3) silt loam; common medium distinct yellowish brown (10YR 5/6) and light brownish gray (2.5Y 6/2) mottles; weak medium and coarse subangular blocky structure; very friable; common fine roots; many fine pores; few root channels; very strongly acid; gradual wavy boundary.

E/B—22 to 24 inches; light brownish gray (10YR 6/2) part E embedded with yellowish brown (10YR 5/6) peds of part B; silt loam; moderate coarse subangular blocky structure; friable; few fine pores; very strongly acid; gradual wavy boundary.

B'x1—24 to 40 inches; mottled yellowish brown (10YR 5/6) and light brownish gray (2.5Y 6/2) silty clay loam; moderate coarse prismatic structure parting to moderate fine subangular blocky; firm, compact and brittle; gray clay in cracks between prisms; very strongly acid; gradual smooth boundary.

B'x2—40 to 65 inches; yellowish brown (10YR 5/6) silt loam; common distinct light brownish gray (10YR 6/2) mottles; weak coarse prismatic structure parting to weak medium subangular blocky; firm, compact and brittle; very strongly acid.

The thickness of the solum is more than 60 inches. Depth to bedrock is more than 60 inches. Thickness of the loess is more than 48 inches. Depth to the fragipan ranges from 16 to 30 inches. Reaction is strongly acid or very strongly acid throughout except in areas that have been limed.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 to 4.

The Bw horizon has hue of 10YR or 2.5Y and value of 4 to 7. Dominant colors have chroma of 3 to 6, and mottles have chroma of 1 or 2. Mottles are few to many. Texture is heavy silt loam or light silty clay loam. Some pedons have a few thin, patchy clay films.

The E part of the E/B horizon has hue of 10YR, value of 6 or 7, and chroma of 1 to 3. Texture is silt loam or silt.

The B'x horizon has hue of 10YR or 2.5Y, value of 5 to 7, and chroma of 1 to 6. Texture is silt loam or silty clay loam.

The Calloway soils in this county are a taxadjunct to the Calloway series because the Calloway series is in the thermic soil temperature regime, and Ohio County is in the mesic temperature regime. These soils do not differ from the Calloway series in use, management, or behavior.

Caneyville Series

The Caneyville series consists of moderately deep, well drained soils that have moderately slow permeability. They formed in residuum weathered from limestone. Caneyville soils are on side slopes and narrow hilltops. Slope ranges from 6 to 20 percent.

Caneyville soils are associated with Wellston, Frondorf, Rosine, and Zanesville soils. Wellston soils are deep to sandstone and shale bedrock and have less clay in the subsoil than Caneyville soils. Frondorf soils formed mostly in residuum from siltstone and sandstone and also have less clay in the subsoil. Rosine soils formed partly in soft, acid clayey shale and are deeper to bedrock than Caneyville soils. Zanesville soils are deeper to bedrock and have a fragipan.

Typical pedon of Caneyville silt loam in an area of Rosine and Caneyville silt loams, 12 to 20 percent slopes, eroded; 4 miles northeast of Hartford, 0.5 mile south of Concord Church, on the east side of Kentucky Highway 69, on soil map sheet 25, east-west 1,681,000 feet and north-south 426,000 feet by Kentucky grid coordinates:

O—1 to 0 inch; undecomposed hardwood leaf litter.

A—0 to 5 inches; dark brown (7.5YR 3/2) silt loam; moderate fine granular structure; very friable; many fine to coarse roots; 2 percent thin flat siltstone fragments 1/4 to 1 inch long; slightly acid; clear smooth boundary.

Bt1—5 to 12 inches; yellowish red (5YR 4/6) clay; strong fine and very fine angular and subangular blocky structure; very firm; thick continuous clay films; common fine and medium roots; 5 percent flat sandstone and siltstone fragments 1/4 inch long; few black stains on ped faces; strongly acid; diffuse smooth boundary.

Bt2—12 to 30 inches; reddish brown (5YR 4/4) clay, common medium faint dark brown (7.5YR 4/4) mottles; strong fine and very fine angular and subangular blocky structure; very firm; few worm

casts; common fine and medium roots; thick continuous clay films; medium acid.
R—30 inches; gray massive limestone.

The thickness of the solum and depth to bedrock range from 20 to 40 inches. Reaction ranges from very strongly acid to slightly acid in the upper part of the solum and is medium acid or slightly acid in the lower part.

The A horizon has hue of 7.5YR or 10YR, value of 3 or 4, and chroma of 2 or 3. Some pedons have an E horizon that has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. Cultivated soils have an Ap horizon that has colors similar to the E horizon. Limestone, siltstone, or sandstone fragments range from 0 to 15 percent.

The Bt1 horizon has hue of 7.5YR to 2.5YR, value of 4 or 5, and chroma of 4 to 6. Texture is silty clay loam to clay. The Bt2 horizon has hue of 10YR to 2.5YR, value of 4 to 6, and chroma of 2 to 6. Mottles are in shades of gray, yellow, brown, or red. Texture is silty clay or clay.

Some pedons have a BC or C horizon in shades of gray, yellow, brown, or red.

Clifty Series

The Clifty series consists of deep, well drained soils that have moderately rapid permeability. They formed in alluvium derived from acid siltstone, sandstone, shale, and loess. Clifty soils are on flood plains near heads of streams. Slope ranges from 0 to 2 percent.

Clifty soils are associated with Cuba, Steff, Stendal, Bonnie, Nolin, Lindside, Newark, and Melvin soils on flood plains and Wellston, Frondorf, Rosine, and Zanesville soils on uplands. These soils have less gravel in the upper part of the solum than Clifty soils. Steff, Stendal, Bonnie, Lindside, Newark, and Melvin soils are less well drained and have gray mottles in the subsoil. Wellston, Frondorf, Rosine, and Zanesville soils have an argillic horizon.

Typical pedon of Clifty gravelly silt loam, occasionally flooded; 5 miles north of Hartford on Whoopee Hill Road, 0.5 mile west of Crooked Pond, 100 feet north of Whoopee Hill Road, on soil map sheet 24, east-west 1,666,500 feet and north-south 430,000 feet by Kentucky grid coordinates:

Ap—0 to 9 inches; brown (10YR 4/3) gravelly silt loam; weak fine granular structure; very friable; many fine and medium roots, many fine pores and wormholes; 20 percent coarse fragments 1/8 to 1/2 inch across; neutral; abrupt smooth boundary.
Bw1—9 to 18 inches; dark yellowish brown (10YR 4/4) gravelly silt loam; weak fine granular structure; very friable; common fine and medium roots; common fine pores; 25 percent coarse fragments 1/8 to 3/4 inch across; strongly acid; gradual smooth boundary.
Bw2—18 to 38 inches; yellowish brown (10YR 5/4) gravelly silt loam; moderate fine granular structure; very friable; few fine roots and pores; 25 percent coarse fragments 1/4 inch to 2 inches across; very strongly acid; gradual wavy boundary.
C—38 to 60 inches; yellowish brown (10YR 5/4) gravelly loam; massive; very friable; 35 percent coarse fragments 1/4 inch to 3 inches across; strongly acid.

The thickness of the solum ranges from 20 to 40 inches. Depth to bedrock is more than 48 inches. The content of pebbles and cobbles ranges from 15 to 35 percent in the solum and from 20 to 70 percent in the lower part of the pedon. The soil is strongly acid or very strongly acid throughout except in areas that have been limed.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4.

The Bw horizon has hue of 10YR, value of 4 or 5, and chroma of 3 to 6. Texture of the fine-earth fraction is silt loam or loam.

The C horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. Gray mottles are in some pedons. Texture of the fine-earth fraction ranges from silt loam to sandy loam. In some pedons the C horizon is stratified.

The Clifty soils in this county are a taxadjunct to the Clifty series because the B horizon contains less clay than defined in the range for the Clifty series. These soils do not differ from the Clifty series in use, management, or behavior.

Cuba Series

The Cuba series consists of deep, well drained soils that have moderate permeability. They formed in alluvium that has a high content of silt. Cuba soils are on flood plains in narrow valleys or near large streams. Slope is mostly less than 2 percent but ranges up to about 3 percent.

Cuba soils are associated with Pope, Clifty, Steff, Stendal, and Bonnie soils on flood plains and Wellston and Frondorf soils on uplands. Pope soils contain more sand in the solum than Cuba soils, and Clifty soils contain more gravel. Steff, Stendal, and Bonnie soils are not as well drained and have a higher percentage of gray in the subsoil than Cuba soils. Wellston and Frondorf soils have an argillic horizon.

Typical pedon of Cuba silt loam, occasionally flooded; 5 miles northeast of Hartford, 2 miles east of Kentucky Highway 69, 0.5 mile north of Kentucky Highway 1164, 500 feet north of a lake, on soil map sheet 25, east-west 2,685,500 feet and north-south 425,000 feet by Kentucky grid coordinates:

Ap—0 to 8 inches; dark brown (10YR 4/3) silt loam; moderate fine granular and subangular blocky

structure; very friable; many fine roots; few earthworms; medium acid; abrupt smooth boundary.
Bw—8 to 24 inches; yellowish brown (10YR 5/4) silt loam; weak fine to coarse subangular blocky structure; very friable; common fine roots; very strongly acid; gradual smooth boundary.
C1—24 to 48 inches; brown (10YR 4/3) silt loam; massive; very friable; few fine roots; very strongly acid; gradual smooth boundary.
C2—48 to 60 inches; brown (10YR 4/3) silt loam; few fine faint grayish brown and dark brown mottles; massive; very friable; 5 percent sandstone fragments 1/4 to 1 inch across; very strongly acid.

The thickness of the solum ranges from 20 to 40 inches. Depth to bedrock is more than 60 inches. The soil is strongly acid or very strongly acid throughout except in areas that have been limed.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 to 4.

The Bw horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 or 4. In some pedons, it is mottled in chroma of 1 or 2 below a depth of 20 inches. The structure is weak, fine to coarse, granular or subangular blocky.

The C horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 1 to 6. In most pedons, it is mottled in shades of brown and gray. Texture is silt loam or loam.

Elk Series

The Elk series consists of deep, well drained soils that have moderate permeability. These soils are on stream terraces in mixed alluvium deposited by the Green River and the Rough River. Slope ranges from 0 to 6 percent.

Elk soils are associated with Otwell, Weinbach, Nolin, Lindside, Newark, Melvin, and Wellston soils. Otwell and Weinbach soils have a fragipan. Nolin, Lindside, Newark, and Melvin soils do not have an argillic horizon. Weinbach, Lindside, Newark, and Melvin soils have gray in the subsoil. Wellston soils are similar to Elk soils but are on uplands and are not underlain by stratified sediment.

Typical pedon of Elk silt loam, 0 to 2 percent slopes; 3 miles northwest of Point Pleasant, 1.2 miles southeast of the confluence of Rough River and Green River, on soil map sheet 28, east-west 1,600,000 feet and north-south 422,000 feet by Kentucky grid coordinates:

Ap—0 to 9 inches; dark brown (10YR 4/3) silt loam; weak fine granular structure; very friable; neutral; clear smooth boundary.
BA—9 to 15 inches; brown (10YR 4/3) silt loam; weak fine subangular blocky structure; friable; medium acid; clear smooth boundary.
Bt—15 to 50 inches; strong brown (7.5YR 5/6) silt loam; weak fine and medium subangular blocky structure; friable; thin patchy clay films; medium acid; gradual smooth boundary.
C—50 to 60 inches; strong brown (7.5YR 5/6) silt loam; few fine faint yellowish brown mottles; massive; friable; few clay films on root channels; medium acid.

The depth to bedrock is more than 60 inches and is as much as 100 feet in some places. The solum thickness ranges from 40 to 50 inches. Reaction is medium acid to very strongly acid throughout except in areas that have been limed.

The Ap and BA horizons have hue of 10YR, value of 4, and chroma of 3 or 4.

The Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 6. In some pedons, the lower part of the Bt horizon is mottled in chroma of 1 or 2. Texture of the B horizon is silt loam or silty clay loam.

The C horizon has hue of 7.5YR, value of 4 or 5, and chroma of 4 to 6. Mottles that have chroma of 1 to 3 are in most pedons. Texture ranges from loam through silty clay loam.

Fairpoint Series

The Fairpoint series consists of deep, well drained soils that have moderately slow permeability. These soils formed in material that was moved in the mining of coal. The material is broken and crushed pieces of bedrock that were above the coal. Slope ranges from 2 to 70 percent.

Fairpoint soils are associated with Bethesda, Morristown, Wellston, Zanesville, Frondorf, and Rosine soils. Bethesda soils are more acid than Fairpoint soils, and Morristown soils are calcareous. The other soils are not as deep to bedrock, contain fewer rock fragments, and have a more developed profile.

Typical pedon of Fairpoint channery silt loam in an area of Fairpoint, Bethesda, and Morristown soils, 6 to 20 percent slopes; 2 miles east of Centertown, 0.5 mile south of Kentucky Highway 69, and 200 feet west of a county road, on soil map sheet 36, east-west 1,650,000 feet and north-south 393,000 feet by Kentucky grid coordinates:

Ap—0 to 4 inches; dark brown (10YR 4/3) channery silt loam; weak fine granular structure; friable; 30 percent randomly oriented gray siltstone fragments 1/4 inch to 2 inches long; common fine roots; neutral; abrupt smooth boundary.
C1—4 to 20 inches; dark grayish brown (2.5Y 4/2) channery silt loam; massive; friable; 30 percent thin randomly oriented gray siltstone fragments 1/2 inch to 4 inches long; neutral; clear wavy boundary.
C2—20 to 25 inches; strong brown (7.5YR 5/6) silty clay; common medium distinct light gray (10YR 7/1)

mottles; weak very fine subangular blocky structure; plastic; strongly acid; clear wavy boundary.
C3—25 to 60 inches; variegated dark gray (10YR 4/1) and brown (10YR 4/3) channery silt loam; massive; friable; 35 percent thin randomly oriented gray siltstone and shale fragments 1/4 inch to 2 inches long and 15 percent subrounded brown sandstone fragments 1/2 inch to 4 inches across; one hard sandstone boulder and one soft siltstone boulder, about 2 feet in diameter; few pieces of strong brown silty clay loam 1/2 inch in diameter; neutral.

The thickness of the material is more than 6 feet and is 60 to 100 feet in most places. Reaction generally ranges from medium acid to neutral throughout; however, where topsoil has been added reaction in the A horizon can range to very strongly acid. Content of rock fragments ranges from 5 to 75 percent in individual horizons, but the weighted average between depths of 10 and 40 inches is more than 35 percent. Rock fragments include shale, siltstone, sandstone, limestone, and coal. Most fragments of shale are 1/8 to 1/2 inch thick and 1 inch to 4 inches long. Most fragments of sandstone and siltstone range from 1/4 inch to 8 inches in length, but a few pieces of sandstone are as large as 6 feet in diameter.

Soils that have been covered with topsoil have an A horizon of natural soil material that is silt loam 4 to 12 inches thick. The A horizon has hue of 7.5YR or 10YR, value of 3 to 6, and chroma of 1 to 6. It is variegated in most pedons.

The C horizon has dominant colors in hue of 10YR, 2.5Y, and 5Y, value of 3 to 5, and chroma of 1 or 2, or has hue of 7.5YR, value of 5, and chroma of 6 to 8. Mottles are in hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 8. Texture is shaly, very shaly, gravelly, very gravelly, channery, or very channery phases of silty clay loam, loam, clay loam, or silt loam.

Frondorf Series

The Frondorf series consists of moderately deep, well drained soils that have moderate permeability. These soils formed in thin loess and residuum that weathered from acid sandstone and siltstone. They are on side slopes and narrow hilltops. Slope ranges from 12 to 40 percent.

Frondorf soils are associated with Wellston, Zanesville, Rosine, and Caneyville soils. Wellston, Zanesville, and Rosine soils are deeper to bedrock than Frondorf soils. Zanesville soils have a fragipan, and Rosine soils have more clay in the subsoil. Caneyville soils are underlain by limestone and have more clay in the subsoil than Frondorf soils.

Typical pedon of Frondorf silt loam in an area of Frondorf-Wellston-Rosine silt loams, 20 to 30 percent slopes; 7 miles north of Hartford, 2 miles east of Green River Parkway, 200 feet west of Cedar Run Church, on Soil Map Sheet 17, east-west 1,666,000 feet and north-south 440,500 feet by Kentucky grid coordinates:

A—0 to 2 inches; very dark grayish brown (10YR 3/2) silt loam; moderate fine granular structure; very friable; common fine and coarse roots; few partly decayed leaves; 5 percent sandstone fragments 1 inch to 2 inches across; medium acid; abrupt smooth boundary.
E—2 to 5 inches; brown (10YR 5/3) silt loam; weak fine granular structure; very friable; common fine roots; 5 percent sandstone fragments 1 inch to 2 inches across; strongly acid; abrupt smooth boundary.
BA—5 to 10 inches; strong brown (7.5YR 5/6) silt loam; weak fine subangular blocky structure; friable; few fine and coarse roots; very strongly acid; gradual smooth boundary.
Bt1—10 to 20 inches; strong brown (7.5YR 5/6) silt loam; moderate fine and medium subangular blocky structure; friable; few fine and coarse roots; few fine pores; few patchy clay films on peds; strongly acid; gradual smooth boundary.
2Bt2—20 to 30 inches; strong brown (7.5YR 5/6) gravelly silt loam; moderate medium subangular blocky structure; friable; 15 percent sandstone fragments 1/4 inch to 2 inches across; few patchy clay films on peds and fragments; few flakes of mica; strongly acid; gradual smooth boundary.
2C—30 to 36 inches; yellowish brown (10YR 5/6) gravelly loam; peds of the B horizon make up 10 percent of this horizon; massive; firm; 25 percent sandstone fragments; many fine flakes of mica; strongly acid.
2R—36 inches; soft sandstone.

The thickness of the solum ranges from 20 to 40 inches. Depth to bedrock ranges from 20 to 40 inches. Content of pebbles and cobbles ranges from 0 to 5 percent in the upper part of the solum and from 20 to 50 percent in the lower part. Coarse fragments are sandstone and siltstone. Reaction is strongly acid or very strongly acid throughout except in areas that have been limed.

The A horizon has hue of 10YR, value of 3 or 4, and chroma of 2 or 3. The E horizon has hue of 10YR, value of 4 or 5, and chroma of 4 to 6. Cultivated soils have an Ap horizon that has hue of 10YR, value of 4 or 5, and chroma of 3 or 4.

The BA and B horizons have hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 4 to 6. The Bt1 horizon is silt loam or light silty clay loam. The 2Bt2 horizon has pale brown and yellowish brown mottles in some pedons. The fine-earth fraction of the 2Bt2 horizon ranges from loam to silty clay loam. The consistence is friable or firm.

The 2C horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 5 or 6. Texture of the fine-earth

fraction ranges from sandy loam to silty clay loam. Some pedons do not have a 2C horizon.

Henshaw Series

The Henshaw series consists of deep, somewhat poorly drained, moderately slowly permeable soils on stream terraces. They formed in alluvium. Slope ranges from 0 to 4 percent.

Henshaw soils are similar to and associated with McGary, Weinbach, Newark, and Calloway soils. McGary soils have more clay in the subsoil than the Henshaw soils. Weinbach soils have a fragipan and are more acid in the substratum. Newark soils do not have an argillic horizon. Calloway soils are similar in drainage but have a fragipan and are on uplands.

Typical pedon of Henshaw silt loam; 3 miles west of U.S. Highway 231, 1 mile south of Kentucky Highway 136, 50 feet north of a graveled road, on soil map sheet 30, east-west 1,636,500 feet and north-south 418,000 feet by Kentucky grid coordinates:

Ap—0 to 9 inches; brown (10YR 4/3) silt loam; few fine faint pale brown mottles; weak fine granular structure; very friable; many roots; few worm casts; neutral; abrupt smooth boundary.

Bt1—9 to 18 inches; mottled yellowish brown (10YR 5/6), dark yellowish brown (10YR 4/4), and light brownish gray (2.5YR 6/2) silt loam; weak medium prismatic structure parting to moderate fine and medium angular and subangular blocky; firm; many wormholes; few roots and concretions; thin clay films; medium acid; gradual smooth boundary.

Bt2—18 to 30 inches; mottled yellowish brown (10YR 5/6), light brownish gray (2.5Y 6/2), and light gray (10YR 7/1) silt loam; weak medium prismatic structure parting to moderate fine and medium angular and subangular blocky; firm; few roots and concretions; light brownish gray (2.5Y 6/2) clay films on ped surfaces; slightly acid; gradual smooth boundary.

BC—30 to 40 inches; yellowish brown (10YR 5/6) silty clay loam; many moderate distinct dark brown (10YR 3/3) and light gray (10YR 7/1) mottles; weak medium prismatic structure parting to moderate fine and medium angular and subangular blocky; firm; few dark concretions; mildly alkaline; gradual smooth boundary.

C—40 to 60 inches; mottled strong brown (7.5YR 5/6), yellowish brown (10YR 5/4), and light gray (10YR 6/1) silt loam; massive; firm; mildly alkaline.

The thickness of the solum ranges from 30 to 50 inches. The depth to bedrock is more than 60 inches and as much as 100 feet in a few places. Reaction in the upper part of the profile ranges from strongly acid to slightly acid except in areas that have been limed. Reaction in the lower part of the profile ranges from slightly acid to mildly alkaline.

The A horizon has hue of 10YR, value of 4 or 5, and chroma of 2 or 3.

The Bt and BC horizons have hue of 2.5Y or 10YR, value of 4 or 5, and chroma of 4 to 6. Mottles are in shades of gray or brown. Texture is silt loam or silty clay loam. In some pedons, the blocky peds are stacked into weak coarse prismatic structure.

The C horizon is mottled in shades of gray and brown. It has hue of 10YR, value of 5 or 6, and chroma of 4 to 8, and hue of 10YR and 2.5Y, value 5 to 7, and chroma of 1 or 2. Texture is silt loam or silty clay loam. Some pedons have calcium carbonate concretions.

Hosmer Series

The Hosmer series consists of deep, moderately well drained, moderately slowly permeable soils on loess covered uplands. They formed in loess that is more than 48 inches thick. Slope ranges from 2 to 6 percent.

Hosmer soils are similar to and associated with Sadler, Zanesville, and Wellston soils. Sadler soils have a bisequum. Wellston soils do not have a fragipan. Sadler, Wellston, and Zanesville soils formed in loess and the underlying residuum, and they are not as deep to bedrock as Hosmer soils. Hosmer soils are similar to Otwell soils that formed on stream terraces and are deeper to bedrock.

Typical pedon of Hosmer silt loam, 2 to 6 percent slopes, eroded; 1 mile east of Pleasant Ridge, 0.25 mile south of Bells Run Road along a coal haul road, on soil map sheet 9, east-west 1,646,000 feet and north-south 459,000 feet by Kentucky grid coordinates:

Ap—0 to 8 inches; brown (10YR 4/3) silt loam; weak fine granular structure; very friable; many roots; slightly acid; clear smooth boundary.

BA—8 to 15 inches; brown (7.5YR 4/4) silt loam; weak medium subangular blocky structure; friable; few roots; medium acid; gradual smooth boundary.

Bt1—15 to 22 inches; strong brown (7.5YR 5/6) silty clay loam; moderate fine subangular blocky structure; firm; patchy clay films; medium acid; gradual smooth boundary.

Bt2—22 to 30 inches; strong brown (7.5YR 5/6) silt loam; common medium distinct pale brown (10YR 6/3) mottles; weak fine and medium subangular blocky structure; friable; few patchy clay films; strongly acid; clear wavy boundary.

Btx1—30 to 48 inches; strong brown (7.5YR 5/6) silt loam; common fine faint light yellowish brown (10YR 6/4) mottles; moderate very coarse prismatic structure parting to moderate fine and medium subangular blocky; firm, brittle and compact; brown (7.5YR 4/4) clay films on blocky peds; light gray

(10YR 7/2) silt loam wedges between prisms, few black stains; strongly acid; gradual wavy boundary.

Btx2—48 to 70 inches; brown (7.5YR 4/4) silt loam; moderate very coarse prismatic structure parting to weak medium subangular blocky; firm, brittle and compact; light brownish gray (10YR 6/2) silt loam wedges 1/2 to 1 inch wide between prisms, clay films on blocky peds at edge of polygon, few black stains; strongly acid.

The thickness of the loess ranges from 48 to 75 inches. Depth to the fragipan ranges from 24 to 33 inches. Depth to bedrock ranges from 75 to 90 inches. Reaction ranges from medium acid to very strongly acid throughout except in areas that have been limed.

The A horizon has hue of 10YR, value of 4, and chroma of 3 or 4.

The BA horizon has hue of 7.5YR, value of 4 or 5, and chroma of 4 to 6. The texture is silt loam or silty clay loam. Some pedons do not have a BA horizon.

The Bt horizon has hue of 7.5YR, value of 4 or 5, and chroma of 4 to 6. Texture is silt loam or silty clay loam. The Bt2 horizon has pale brown to light gray mottles in some pedons.

The Btx horizon has hue of 10YR or 7.5YR, value of 4 to 7, and chroma of 1 to 6. It commonly is mottled in shades of gray and brown.

In some pedons, the 2B horizon is residuum weathered from sandstone, siltstone, or shale. It is variable in color. Texture ranges from clay to sandy loam.

Karnak Series

The Karnak series consists of deep, poorly drained, slowly permeable soils on flood plains. They formed in slack water alluvium. Slope ranges from 0 to 2 percent.

Karnak soils are associated with McGary and Henshaw soils on stream terraces and Melvin soils on flood plains. McGary and Henshaw soils have an argillic horizon, are better drained, and have a lower percentage of gray colors in the subsoil than Karnak soils. Melvin soils contain less clay throughout.

Typical pedon of Karnak silty clay, occasionally flooded; 4 miles west of Hartford on Johnson School Road, 0.25 mile west of turn in road, 0.5 mile east of the Rough River, 3 miles south of Kentucky Highway 136, on soil map sheet 30, east-west 1,643,000 feet and north-south 409,000 feet by Kentucky grid coordinates:

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) silty clay; weak fine granular structure; sticky; few roots; neutral; abrupt smooth boundary.

Bg1—8 to 26 inches; light gray (10YR 6/1) silty clay; many moderate distinct strong brown (7.5YR 5/6) mottles; weak fine angular blocky structure; very plastic; few roots; few black concretionary stains; light gray (10YR 6/1) on pressure faces; slightly acid; diffuse smooth boundary.

Bg2—26 to 40 inches; light gray (10YR 6/1) clay; many moderate distinct yellowish brown (10YR 5/6) mottles; weak very fine angular blocky structure; very plastic; few pores; few black concretionary stains; neutral; diffuse smooth boundary.

Cg—40 to 60 inches; mottled gray (10YR 5/1), yellowish brown (10YR 5/6), and light olive brown (2.5Y 5/4) clay; massive; very plastic; few black concretionary stains; neutral.

The thickness of the solum ranges from 30 to 60 inches. Reaction is medium acid to neutral except in areas that have been limed. Depth to bedrock is more than 60 inches and as much as 100 feet in a few places.

The Ap horizon has hue of 10YR, value of 4, and chroma of 2 or 3.

The Bg horizon has hue of 10YR, 2.5Y, or 5Y, value of 5 or 6, and chroma of 1 or 2. Mottles are in hue of 10YR and 7.5YR, value of 5, and chroma of 4 to 6. Texture is silty clay or clay. The Bg horizon has weak, very fine or fine, subangular or angular blocky structure.

The Cg horizon has hue of 10YR, value of 5 or 6, and chroma of 1 or 2, or it is neutral. Mottles are in hue of 10YR to 2.5Y, value of 5, and chroma of 4 to 6.

Lindside Series

The Lindside series consists of deep, moderately well drained soils that have moderate permeability. These soils formed in alluvium derived from limestone, sandstone, siltstone, shale, and loess. Lindside soils are on flood plains. Slopes range from 0 to 2 percent.

Lindside soils are associated with Nolin, Newark, and Melvin soils on flood plains and Elk, Otwell, and Weinbach soils on stream terraces. Nolin soils are better drained than Lindside soils and do not have gray in the upper part of the subsoil. Newark and Melvin soils have poorer drainage and a higher percentage of gray in the subsoil. Elk, Otwell, and Weinbach soils have an argillic horizon. Elk soils are better drained than Lindside soils and do not have gray in the subsoil. Otwell and Weinbach soils have a fragipan.

Typical pedon of Lindside silt loam, occasionally flooded; 4 miles north of Centertown, 100 yards southeast of the Rough River, on soil map sheet 30, east-west 1,639,000 feet and north-south 419,000 feet by Kentucky grid coordinates:

Ap—0 to 8 inches; dark brown (10YR 4/3) silt loam; moderate fine granular structure; very friable; common fine roots; few wormholes, slightly acid; abrupt smooth boundary.

Bw1—8 to 20 inches; brown (10YR 5/3) silt loam; weak fine to medium subangular blocky structure; friable;

few fine roots; few fine pores; few wormholes and worm casts; medium acid; gradual smooth boundary.
Bw2—20 to 30 inches; brown (10YR 5/3) silt loam; common fine faint dark brown (10YR 4/3) mottles and few fine faint grayish brown mottles; weak fine to medium subangular blocky structure; friable; few pores; medium acid; gradual smooth boundary.
Cg—30 to 60 inches; grayish brown (10YR 5/2) silt loam; common medium faint brown (10YR 4/3) mottles and few fine distinct dark brown (10YR 3/3) mottles; massive; friable; few very fine roots; common pores; few black concretions; medium acid.

The thickness of the solum ranges from 30 to 50 inches. Depth to bedrock is more than 60 inches and as much as 100 feet in a few places. The soil ranges from strongly acid to slightly acid throughout.

The A horizon has hue of 10YR, value of 3 or 4, and chroma of 2 or 3. Forested soils have a dark brown A horizon 1 inch to 3 inches thick.

The upper part of the Bw horizon has dominant colors in hue of 10YR, value of 4 or 5, and chroma of 3 or 4. Mottles are in hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 1 to 3. In some pedons, the lower part of the Bw horizon has dominant colors in hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 1 to 3. Above a depth of 24 inches, some mottles have chroma of 2 or less. Structure is fine or medium, granular or subangular blocky. Texture is silt loam or silty clay loam.

The Cg horizon has hue of 7.5YR, 10YR, and 2.5Y, value of 4 to 6, and chroma of 1 to 4. Texture is silt loam or silty clay loam.

McGary Series

The McGary series consists of deep, somewhat poorly drained soils that have slow permeability. They formed in slack water clay on low stream terraces in the Green River and Rough River valleys. Slope is mostly less than 2 percent but ranges up to 5 percent.

McGary soils are associated with Karnak, Henshaw, and Weinbach soils. Karnak soils do not have an argillic horizon, and they have poorer drainage and a higher percentage of gray in the subsoil than McGary soils. Henshaw and Weinbach soils have less clay in the subsoil than McGary soils. Weinbach soils also have a fragipan.

Typical pedon of McGary silt loam; 3 miles northwest of Mantanzas, 0.3 mile south of the Rough River, 0.5 mile southwest of a farm house, 400 feet east of a farm road, on soil map sheet 28, east-west 1,613,000 feet and north-south 423,000 feet by Kentucky grid coordinates:

Ap—0 to 9 inches; brown (10YR 4/3) silt loam, moderate fine granular and weak medium subangular blocky structure; very friable; few fine roots; few worm casts; slightly acid; abrupt smooth boundary.
Bt1—9 to 20 inches; mottled light brownish gray (2.5Y 6/2) and yellowish brown (10YR 5/6) silty clay loam; moderate fine and very fine subangular blocky structure; firm; few fine roots; few thin patchy clay films; strongly acid; gradual smooth boundary.
Bt2—20 to 38 inches; yellowish brown (10YR 5/4) silty clay; many medium distinct grayish brown (10YR 5/2) mottles; strong fine and very fine angular blocky structure; firm; few dark brown concretionary stains; grayish brown clay films on ped surfaces; medium acid; gradual smooth boundary.
BC—38 to 50 inches; yellowish brown (10YR 5/4, 5/6) silty clay; many medium distinct light brownish gray (10YR 6/2) mottles; moderate fine subangular blocky structure; firm; few dark brown concretionary stains; slightly acid; diffuse smooth boundary.
C—50 to 60 inches; yellowish brown (10YR 5/8) silty clay; many coarse distinct light brownish gray (2.5Y 6/2) mottles; weak fine subangular blocky structure; firm; neutral.

The thickness of the solum ranges from 30 to 55 inches. Depth to bedrock is more than 60 inches and is as much as 100 feet in a few places. Reaction in the upper part of the solum is strongly acid or medium acid except in areas that have been limed. Reaction in the lower part ranges from medium acid to mildly alkaline.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 or 3. Forested soils have an A horizon that has hue of 10YR, value of 3 or 4, and chroma of 1 to 3 and an E horizon that has hue of 10YR, value of 5 or 6, and chroma of 1 to 3.

The Bt horizon is mottled in shades of gray and brown. It has hue of 10YR or 2.5Y, value of 5 to 7, and chroma of 1 or 2, and hue of 10YR, value of 5, and chroma of 4 to 8. Texture is silty clay or silty clay loam.

The BC and C horizons have hue of 10YR or 2.5Y, value of 5 to 7, and chroma of 1 to 6. Mottles are in shades of gray and brown. Texture ranges from silty clay loam to clay. The BC and C horizons have lime concretions in some pedons.

Melvin Series

The Melvin series consists of deep, poorly drained soils that have moderate permeability. They formed in mixed alluvium on flood plains of the Green River and the Rough River. Slope ranges from 0 to 2 percent but is mostly less than 1 percent.

Melvin soils are associated with Nolin, Lindside, Newark, and Karnak soils. Nolin, Lindside, and Newark soils are better drained and have a lower percentage of gray in the subsoil than Melvin soils. Karnak soils contain more clay throughout.

Typical pedon of Melvin silt loam, occasionally flooded; 3.5 miles west of Hartford on Johnson School Road, 0.25 mile north of Johnson School Road, 0.25

mile west of Mud College Road, 2 miles south of No Creek Church on Kentucky Highway 136, on soil map sheet 32, east-west 1,649,000 feet and north-south 409,000 feet by Kentucky grid coordinates:

Ap—0 to 6 inches; grayish brown (10YR 5/2) silt loam; few fine distinct strong brown (7.5YR 5/6) mottles; weak fine granular structure; very friable; many fine roots; slightly acid; abrupt smooth boundary.

Bg1—6 to 24 inches; light gray (10YR 6/1) silt loam; many common distinct yellowish brown (10YR 5/6) mottles; weak fine subangular blocky structure; friable; common fine roots; neutral; gradual wavy boundary.

Bg2—24 to 40 inches; gray (10YR 5/1) silt loam; many common distinct yellowish brown (10YR 5/6) mottles; weak fine subangular blocky structure; few fine roots; few brown concretions; friable; mildly alkaline; gradual wavy boundary.

Cg—40 to 65 inches; mottled gray (10YR 5/1) and yellowish brown (10YR 5/6) silty clay loam; massive; few brown concretions; friable; mildly alkaline.

The thickness of the solum ranges from 25 to 40 inches. Depth to bedrock is more than 60 inches and is as deep as 100 feet in a few places. Reaction ranges from medium acid to mildly alkaline throughout.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2.

The Bg and Cg horizons have dominant colors in hue of 10YR to 5Y, value of 5 or 6, and chroma of 1 or 2. Mottles have hue of 7.5YR to 2.5Y, value of 5 or 6, and chroma of 4 to 6. Structure of the Bg horizon is weak or moderate, fine or medium, subangular blocky. Texture of the Bg and Cg horizons is silty clay loam or silt loam.

Morristown Series

The Morristown series consists of deep, well drained soils that have moderately slow permeability. These soils formed in material that was moved in the mining of coal. The material is broken and crushed pieces of bedrock that were above the coal. Slope ranges from 2 to 70 percent.

These soils are associated with Bethesda, Fairpoint, Wellston, Zanesville, Frondorf, and Rosine soils. Bethesda soils are extremely acid, and Fairpoint soils are not calcareous. The other soils are not as deep to bedrock, contain fewer rock fragments, and have a more developed profile than Morristown soils.

Typical pedon of Morristown shaly silt loam in an area of Fairpoint-Bethesda-Morristown soils, 6 to 20 percent slopes; 2 miles east of Hartford, 1 mile south of Kentucky Highway 69, on soil map sheet 32, east-west 1,680,000 feet and north-south 410,500 feet by Kentucky grid coordinates:

Ap—0 to 7 inches; dark gray (10YR 4/1) shaly silt loam; moderate fine and medium angular blocky structure; friable; common fine roots; 35 percent randomly oriented shale, siltstone, and micaceous sandstone fragments 1/8 inch to 2 inches across; mildly alkaline, weak effervescence; gradual smooth boundary.

C1—7 to 17 inches; dark gray (5Y 4/1) gravelly silt loam, 5 percent chunks of brown; moderate fine and medium angular blocky structure; friable; common fine roots; few fine pores; 35 percent randomly oriented subrounded sandstone, siltstone, and shale fragments 1 inch to 2 inches across, mildly alkaline, weak effervescence; gradual wavy boundary.

C2—17 to 27 inches; dark gray (5Y 4/1) gravelly silt loam; weak fine and medium subangular blocky structure; friable; few fine roots; few fine pores; 40 percent randomly oriented subrounded siltstone, sandstone, and shale fragments 1 inch to 4 inches across; mildly alkaline, weak effervescence; gradual wavy boundary.

C3—27 to 50 inches; dark gray (5Y 4/1) very gravelly silt loam; weak fine and medium subangular blocky structure; firm; few fine roots; 60 percent randomly oriented subrounded siltstone and shale fragments and a few sandstone fragments mostly 1 inch to 5 inches across; neutral, weak effervescence; gradual wavy boundary.

C4—50 to 70 inches; olive gray (5Y 4/2) cobbly silt loam; weak medium subangular blocky structure; 60 percent randomly oriented subrounded siltstone, sandstone, and shale fragments 3 to 6 inches across; neutral, weak effervescence.

The thickness of the material is more than 6 feet and is 50 to 100 feet in most places. Reaction generally ranges from neutral to mildly alkaline throughout; however, where topsoil has been added the reaction in the A horizon can range to very strongly acid. Content of rock fragments ranges from 5 to 75 percent in individual horizons, but the weighted average between depths of 10 and 40 inches is more than 35 percent. Rock fragments include shale, siltstone, sandstone, limestone, and coal. Most fragments of shale are 1/8 to 1/2 inch thick and 1 inch to 4 inches long. Most fragments of sandstone and siltstone range from 1/4 inch to 8 inches in diameter, but a few pieces of sandstone are as large as 6 feet.

Where topsoil has been added, the A horizon is natural soil material that is silt loam 4 to 12 inches thick. This horizon has hue of 7.5YR or 10YR, value of 3 to 6, and chroma of 1 to 6. It is variegated in most pedons.

The C horizon has dominant colors in hue of 10YR or 2.5YR, value of 3 to 5, and chroma of 1 or 2. Mottles have hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 8. Texture is shaly, very shaly, gravelly, very gravelly, channery, or very channery phases of loam,

clay loam, silty clay loam, or silt loam. Individual horizons are silty clay in some pedons, but the weighted average is not heavier than the light silty clay loam.

Newark Series

The Newark series consists of deep, somewhat poorly drained soils that have moderate permeability. They formed on flood plains of the Green River and the Rough River in mixed alluvium. Slope ranges from 0 to 2 percent.

Newark soils are associated with Nolin, Lindside, and Melvin soils on flood plains and Elk, Otwell, and Weinbach soils on stream terraces. Nolin and Lindside soils are better drained and have a lower percentage of gray mottles in the subsoil than Newark series. Melvin soils are not as well drained and have more gray mottles in the subsoil. Elk, Otwell, and Weinbach soils have an argillic horizon. Elk and Otwell soils are better drained and have fewer gray mottles in the subsoil than Newark soils. Otwell and Weinbach soils have a fragipan.

Typical pedon of Newark silt loam, occasionally flooded; 0.5 mile north of Dundee, 0.25 mile north of the Rough River, 1,500 feet northwest of Kentucky Highway 69 and 100 feet south of a gravel road, on soil map sheet 19, east-west 1,680,000 feet and north-south 450,000 feet by Kentucky grid coordinates:

Ap—0 to 8 inches; brown (10YR 4/3) silt loam; weak fine granular structure; very friable; many fine roots and pores; few pieces of organic matter; neutral; abrupt smooth boundary.

Bw—8 to 14 inches; dark yellowish brown (10YR 4/4) silt loam; moderate medium and coarse subangular blocky structure; friable; common fine and medium roots and fine pores; slightly acid; abrupt smooth boundary.

Bg—14 to 42 inches; gray (10YR 6/1) silt loam; common medium distinct yellowish brown (10YR 5/4, 5/6) mottles; weak coarse subangular blocky structure; very friable; common fine and medium roots in the upper 20 inches; common brown and black concretions; slightly acid; gradual smooth boundary.

Cg—42 to 66 inches; mottled gray (10YR 6/1) and dark yellowish brown (10YR 4/4) silt loam; massive; very friable; few dark brown concretions and common black iron and manganese stains; medium acid.

The thickness of the solum ranges from 30 to 44 inches. The depth to bedrock is more than 60 inches and as much as 100 feet in a few places. The soil is medium acid to neutral throughout.

The Ap horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 or 4.

The Bw horizon has hue of 7.5YR or 10YR, value of 3 to 5, and chroma of 2 to 4. Mottles are in shades of brown or gray. Texture is silt loam or silty clay loam. The structure is fine or medium, granular or subangular blocky.

The Bg horizon has matrix colors in hue of 2.5Y, 10YR, or 7.5YR, value of 4 to 7, and chroma of 1 or 2. Mottles have chroma of 3 to 6. The depth to the Bg horizon ranges from 10 to 20 inches. The texture and structure of the Bg horizon are similar to those of the Bw horizon.

The Cg horizon has colors and texture that are similar to those in the Bg horizon.

Nolin Series

The Nolin series consists of deep, well drained soils that have moderate permeability. These soils formed in alluvium derived from limestone, sandstone, siltstone, shale, and loess. They are on flood plains near the Green River and the Rough River. Slope is mostly less than 2 percent but ranges up to 3 percent.

Nolin soils are associated with Lindside, Newark, and Melvin soils on flood plains and Elk, Otwell, and Weinbach soils on stream terraces. All of these soils except Elk soils are not as well drained as Nolin soils and have gray mottles in the subsoil. Elk, Otwell, and Weinbach soils have an argillic horizon, and Otwell and Weinbach soils have a fragipan.

Typical pedon of Nolin silt loam, occasionally flooded; 4 miles west of Hartford, 3 miles south of Kentucky Highway 136, 0.5 mile south of turn in Johnson School Road, 100 feet north of the Rough River, on soil map sheet 36, east-west 1,642,000 feet and north-south 406,000 feet by Kentucky grid coordinates:

Ap—0 to 9 inches; dark grayish brown (10YR 4/2) silt loam; weak fine granular structure; very friable; many fine and medium roots; neutral; clear smooth boundary.

Bw1—9 to 18 inches; dark brown (10YR 4/3) silt loam; weak fine subangular blocky structure; friable; many fine and medium roots; many fine pores; slightly acid; gradual smooth boundary.

Bw2—18 to 48 inches; dark yellowish brown (10YR 4/4) silt loam; common fine distinct pale brown (10YR 6/3) mottles in the lower part; weak fine subangular blocky structure; firm; few fine roots and pores; few worm casts; medium acid; gradual smooth boundary.

C—48 to 65 inches; dark yellowish brown (10YR 4/4) silt loam; common fine distinct pale brown (10YR 6/3) mottles; massive; medium acid.

The thickness of the solum is 40 inches or more. The depth to bedrock is more than 60 inches and as much as 100 feet in a few places. Reaction ranges from medium acid to neutral throughout.

The A horizon has hue of 10YR, value of 4, and chroma of 3 or 4.

The Bw horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. In some pedons, it is mottled in chroma of 1 or 2 below a depth of 24 inches. The structure is fine or medium, granular or subangular blocky. Texture is silt loam or silty clay loam.

The C horizon has colors similar to those in the lower part of the Bw horizon. Texture ranges from loam to silty clay loam.

Otwell Series

The Otwell series consists of deep, moderately well drained soils that have a fragipan. Permeability is moderate above the fragipan and slow in the fragipan. These soils formed in mixed alluvium on stream terraces in the Green River and the Rough River valleys. Slope ranges from 0 to 6 percent.

Otwell soils are associated with Elk and Weinbach soils on stream terraces and Nolin, Lindside, Newark, and Melvin soils on flood plains. Elk soils do not have a fragipan. Weinbach soils are more poorly drained and have a higher percentage of gray in the subsoil than Otwell soils. Nolin, Lindside, Newark, and Melvin soils do not have an argillic horizon or a fragipan. Lindside, Newark, and Melvin soils have a higher percentage of gray in the subsoil than Otwell soils.

Typical pedon of Otwell silt loam, 0 to 2 percent slopes; 3 miles north of Matanzas, 1,000 feet south of Lock No. 1, and 100 feet west of Rough River, on soil map sheet 22, east-west 1,618,000 feet and north-south 426,000 feet by Kentucky grid coordinates:

Ap—0 to 8 inches; brown (10YR 4/3) silt loam; weak fine granular structure; very friable; few fine wormholes; common fine and very fine roots; slightly acid; clear smooth boundary.

Bt—8 to 24 inches; yellowish brown (10YR 5/4) silt loam; weak medium subangular blocky structure; few very fine roots mostly along vertical faces of peds; thin patchy clay films on peds; very strongly acid; clear smooth boundary.

Btx—24 to 40 inches; mottled dark yellowish brown (10YR 4/4), strong brown (7.5YR 5/6), and light gray (10YR 6/1) silt loam; weak coarse prismatic structure parting to moderate fine subangular blocky; firm, brittle and compact; few very fine roots mostly between prisms; pale brown (10YR 6/3) in cracks between prisms; very strongly acid; diffuse smooth boundary.

C—40 to 60 inches; yellowish brown (10YR 5/6) silt loam; few fine distinct light brownish gray (2.5Y 6/2) mottles and common medium faint pale brown (10YR 6/3) mottles; massive; friable; few very fine roots; few dark brown stains; strongly acid.

The thickness of the solum ranges from 40 to 65 inches. Depth to bedrock is more than 60 inches and as much as 100 feet in a few places. Depth to the fragipan ranges from 20 to 32 inches. The soil is strongly acid or very strongly acid throughout except in areas that have been limed.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4.

The Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 6. In some pedons, the lower part of the Bt horizon contains a few gray or pale brown mottles. Texture is silt loam or silty clay loam. The structure is weak or moderate, fine or medium.

The Btx horizon has matrix colors in hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 4 to 6. Mottles are in hue of 10YR or 2.5Y, value of 4 to 7, and chroma of 1 or 2. Texture is silt loam or silty clay loam.

The C horizon is mottled in shades of brown and gray. Texture is silt loam or silty clay loam.

Pope Series

The Pope series consists of deep, well drained soils that have moderate to moderately rapid permeability. They formed in recent alluvium that washed from soils formed in residuum weathered from sandstone, siltstone, and shale. Slope ranges from 0 to 3 percent.

Pope soils are associated with Cuba, Steff, Stendal, Clifty, Nolin, and Lindside soils. Cuba, Steff, Stendal, Nolin, and Lindside soils are finer textured than Pope soils. Steff, Stendal, and Lindside soils are not as well drained as Pope soils and have gray in the subsoil that the Pope soils do not have. Clifty soils have gravel in the subsoil.

Typical pedon of Pope fine sandy loam, occasionally flooded; 2 miles north of Hartford, 700 feet south of the Green River Parkway crossing over Rough River, on the west side of the river, on soil map sheet 31, east-west 1,666,000 feet and north-south 418,000 feet by Kentucky grid coordinates:

Ap—0 to 8 inches; brown (10YR 4/3) fine sandy loam; moderate fine granular structure; very friable; many fine roots and pores; neutral; abrupt smooth boundary.

Bw1—8 to 15 inches; dark yellowish brown (10YR 4/4) fine sandy loam; weak coarse subangular blocky structure; very friable; many fine roots; pores and worm casts; strongly acid; gradual smooth boundary.

Bw2—15 to 30 inches; yellowish brown (10YR 5/4) fine sandy loam; few fine distinct light yellowish brown (10YR 6/4) mottles; weak coarse subangular blocky structure; very friable; common fine roots and pores; few worm casts; strongly acid; clear wavy boundary.

C1—30 to 50 inches; pale brown (10YR 6/3) loamy fine sand; common coarse faint light yellowish brown (10YR 6/4) mottles and few fine distinct yellowish brown (10YR 5/6) mottles; massive; very friable; common coarse pockets of dark brown (10YR 4/3) medium sand; strongly acid; clear wavy boundary.

C2—50 to 70 inches; dark yellowish brown (10YR 4/4) fine sandy loam; common medium distinct grayish brown (10YR 5/2) mottles; massive; very friable; very strongly acid.

The thickness of the solum ranges from 30 to 50 inches. The depth to bedrock is more than 60 inches. Reaction is strongly acid or very strongly acid throughout except in areas that have been limed.

The A horizon has hue of 10YR, value of 4, and chroma of 3 or 4. The structure is weak or moderate, fine or medium granular.

The Bw horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 or 4. A few fine mottles that have value of 6 and chroma of 4 or 6 are below a depth of 15 inches. Texture is very fine sandy loam, fine sandy loam, or loam. The structure is medium or coarse, subangular blocky.

The C horizon has dominant colors in hue of 10YR, value of 4 to 6, and chroma of 3 or 4. In most pedons, it is mottled in colors of brown and gray. Texture is fine sandy loam or loamy fine sand. The structure is massive or single grained. The C horizon of most pedons contains thin stratified layers or pockets of sand or sandy loam.

Rosine Series

The Rosine series consists of deep, well drained soils that have moderately slow permeability. They formed in loess and the underlying residuum weathered from shale and interbedded siltstone. Rosine soils are on side slopes. Slope ranges from 6 to 30 percent.

Rosine soils are associated with Frondorf, Wellston, Zanesville, and Caneyville soils. Frondorf, Wellston, and Zanesville soils have less clay in the lower part of the subsoil than Rosine soils. Frondorf soils are not as deep to bedrock. Zanesville soils are on hilltops and have a fragipan. Caneyville soils are not as deep to bedrock and are underlain by limestone instead of shale.

Typical pedon of Rosine silt loam in an area of Frondorf-Wellston-Rosine silt loams, 12 to 20 percent slopes, eroded; 3 miles north of Cromwell, 3 miles east of U.S. Highway 231, 1 mile southeast of Rob Roy, and 1,500 feet southeast of Bald Knob Church, on soil map sheet 46, east-west 1,702,000 feet and north-south 381,000 feet by Kentucky grid coordinates:

O—1/2 to 0 inch; leaf litter and undecomposed organic matter.

A—0 to 1 inch; very dark grayish brown (10YR 3/2) silt loam; moderate fine granular structure; very friable; many very fine roots; strongly acid; abrupt smooth boundary.

E—1 to 4 inches; brown (10YR 5/3) silt loam; weak fine granular structure; very friable; common very fine and fine roots; common fine pores; strongly acid; clear wavy boundary.

Bt1—4 to 22 inches; strong brown (7.5YR 5/6) silty clay loam; weak fine subangular blocky structure; friable; common very fine roots; few very fine pores; common thin patchy clay films; strongly acid; gradual smooth boundary.

2Bt2—22 to 30 inches; yellowish brown (10YR 5/4) silty clay; common medium distinct light brownish gray (10YR 6/2) mottles and few fine distinct brown (7.5YR 5/4) mottles; moderate very fine subangular blocky structure; firm; few fine and medium roots; common patchy clay films; strongly acid; gradual smooth boundary.

2Bt3—30 to 36 inches; strong brown (7.5YR 5/6) silty clay; common coarse distinct light gray (10YR 7/1) mottles; strong fine angular blocky structure; firm; common coarse roots; thin continuous clay films; strongly acid; diffuse smooth boundary.

2Bt4—36 to 50 inches; strong brown (7.5YR 5/6) silty clay; few fine distinct pale brown (10YR 6/3) mottles; strong fine angular blocky structure; firm; strongly acid; clear smooth boundary.

2C—50 to 60 inches; gray (10YR 5/1) shaly silty clay loam; common medium distinct strong brown (7.5YR 5/6) mottles; strong fine angular blocky relict structure; firm; 30 percent shale fragments 1/4 inch to 3 inches long; strongly acid; clear smooth boundary.

2Cr—60 to 70 inches; gray and brown shale and siltstone.

The thickness of the solum ranges from 30 to 60 inches. Depth to soft siltstone or shale ranges from 40 to 80 inches. Except in areas that have been limed, the soil is very strongly acid or strongly acid in the solum and very strongly acid to slightly acid in the C horizon. Sandstone, siltstone, and shale fragments range from 0 to 30 percent in the solum and from 25 to 70 percent in the C horizon.

The A horizon has hue of 10YR, value of 3 or 4, and chroma of 2 or 3. Cultivated soils have an Ap horizon that has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 5.

The E horizon has hue of 10YR, value of 4 or 5, and chroma of 3 to 5.

The Bt1 horizon has hue of 10YR to 5YR, value of 4 or 5, and chroma of 4 to 8. Texture is silt loam or silty clay loam. Structure is weak or moderate, very fine to medium. The 2B horizon has hue of 2.5Y to 5YR, value of 5 to 7, and chroma of 1 to 6. It generally is mottled in shades of brown and gray. Texture is silty clay loam, silty clay, or clay. Structure is weak to strong, very fine to medium, subangular or angular blocky.

The 2C horizon is mottled in shades of brown, gray, yellow, olive, or red. Texture is silty clay loam, silty clay, or clay or their shaly, channery, gravelly, or very shaly analogs. Structure is relict angular blocky or platy.

Sadler Series

The Sadler series consists of deep, moderately well drained soils that have a fragipan. Permeability is moderate above the fragipan and slow in the fragipan. These soils formed in thin loess and residuum from sandstone and siltstone on hilltops and toe slopes. Slope ranges from 0 to 6 percent.

Sadler soils are associated with Zanesville, Wellston, Frondorf, Rosine, Hosmer, and Calloway soils. Zanesville and Hosmer soils do not have a bisequum. Wellston, Frondorf, and Rosine soils do not have a fragipan. Frondorf soils are not as deep to bedrock as Sadler soils, and Hosmer soils are deeper to bedrock. Rosine soils have more clay in the subsoil. Calloway soils are not as well drained and have a higher percentage of gray in the subsoil than Sadler soils.

Typical pedon of Sadler silt loam, 2 to 6 percent slopes, eroded; 1 mile north of Hartford, 0.5 mile east of the Rough River, 500 feet south of Green River Parkway, on soil map sheet 31, east-west 1,668,000 feet and north-south 414,000 feet by Kentucky grid coordinates:

Ap—0 to 8 inches; brown (10YR 4/3) silt loam; moderate fine granular structure; very friable; many small roots; few worm casts; strongly acid; abrupt smooth boundary.

Bt—8 to 24 inches; yellowish brown (10YR 5/6) silt loam, weak fine subangular blocky structure; firm; few small roots; strong brown (7.5YR 5/6) thin clay films in the upper 8 inches; very strongly acid; clear smooth boundary.

E/B—24 to 26 inches; about 50 percent brown (10YR 5/3) silt loam E material coatings on yellowish brown (10YR 5/6) silt loam peds of B material; moderate fine subangular blocky structure; friable E material, firm B material; very strongly acid; clear wavy boundary.

Btx—26 to 45 inches; mottled dark yellowish brown (10YR 4/4) and gray (10YR 6/1) silt loam; moderate very coarse prismatic structure parting to weak fine subangular blocky; very firm, compact and brittle; very strongly acid; clear smooth boundary.

2Bt—45 to 60 inches; mottled yellowish brown (10YR 5/6), light brownish gray (10YR 6/2), and dark yellowish brown (10YR 4/4) gravelly silty clay loam; moderate fine subangular blocky structure; firm; 20 percent sandstone fragments 1/4 to 1 inch across; very strongly acid.

2R—60 inches; sandstone.

The thickness of the loess ranges from 30 to 48 inches. The thickness of the solum ranges from 40 to 60 inches. Depth to bedrock ranges from 50 to 80 inches. Depth to the fragipan ranges from 20 to 32 inches. The soil is strongly acid or very strongly acid throughout except in areas that have been limed.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 to 4.

The Bt horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 4 to 6. The 7.5YR hue is mostly in the upper part of the Bt horizon. Some pedons have pale brown mottles in the lower part. Texture is silt loam or silty clay loam. The structure is weak or moderate and fine or medium.

The E part of the E/B horizon has hue of 10YR, value of 5 or 6, and chroma of 2 or 3. The B part has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 4 to 6. The B part makes up 30 to 50 percent of the horizon.

The Btx horizon has matrix colors in hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 3 to 6. Mottles and material in cracks between prisms are in hue of 10YR or 2.5Y, value of 4 to 7, and chroma of 1 or 2. Texture of the lower part of the Btx horizon ranges from silty clay loam to loam.

The 2Bt horizon has colors similar to those in the Bx horizon. Texture ranges from silty clay to sandy loam or their gravelly or channery counterparts.

Steff Series

The Steff series consists of deep, moderately well drained, moderately permeable soils. They formed in alluvium that washed from soils formed in loess. Steff soils are in narrow valleys, near the base of slopes, and on flood plains. Slope is mostly 0 to 2 percent but ranges up to 4 percent.

Steff soils are associated with Cuba, Stendal, and Bonnie soils. Cuba soils are better drained than Steff soils and do not have gray in the upper part of the subsoil. Stendal and Bonnie soils have poorer drainage than Steff soils and have a higher percentage of gray in the subsoil.

Typical pedon of Steff silt loam, occasionally flooded; 1.5 miles south of Maxwell, 0.5 mile southwest of New Bethel Church, and 100 feet north of a ditch, on soil map sheet 15, east-west 1,628,500 feet and north-south 442,000 feet by Kentucky grid coordinates:

Ap—0 to 8 inches; yellowish brown (10YR 5/4) silt loam; weak fine granular structure; very friable; many very fine roots; neutral; clear smooth boundary.

Bw1—8 to 20 inches; brown (10YR 4/3) silt loam; few fine distinct light gray (10YR 6/1) mottles; weak fine subangular blocky structure; very friable; common very fine roots; strongly acid; gradual smooth boundary.

Bw2—20 to 50 inches; mottled light brownish gray (2.5Y 6/2) and brown (10YR 4/3) silt loam; few fine distinct dark brown (10YR 3/3) mottles; weak medium subangular blocky structure; very friable; few very fine roots in the upper 10 inches; few dark brown concretions; strongly acid; gradual smooth boundary.

C—50 to 60 inches; mottled light gray (2.5Y 7/2) and brown (10YR 4/3) silt loam; few fine distinct dark brown (10YR 3/3) mottles; massive; very friable; few bedding planes and horizontal strata of very fine sand; few dark brown concretions; strongly acid.

The thickness of the solum ranges from 24 to 50 inches. Depth to bedrock is more than 60 inches. Reaction is strongly acid or very strongly acid throughout except in areas that have been limed.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4.

The Bw1 horizon has dominant colors in hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 3 or 4. Mottles have chroma of 1 or 2. Structure is granular or subangular blocky, or it is massive and includes bedding planes in some pedons.

The Bw2 horizon is mottled in shades of gray and brown. It has hue 10YR or 2.5Y, value of 5 to 7, and chroma of 1 or 2, and hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 3 to 6. Structure is weak granular or subangular blocky.

The C horizon has colors similar to the Bw2 horizon. It is stratified in some pedons.

Stendal Series

The Stendal series consists of deep, somewhat poorly drained soils that have moderate permeability. They formed in acid alluvium that washed from loess. Stendal soils are on flood plains. Slope ranges from 0 to 2 percent.

Stendal soils are associated with Cuba, Steff, and Bonnie soils. Cuba and Steff soils have better drainage and less gray in the subsoil than Stendal soils. Bonnie soils have poorer drainage and a higher percentage of gray in the subsoil.

Typical pedon of Stendal silt loam, occasionally flooded; 1.5 miles west of the junction of U.S. Highway 231 and Kentucky Highway 1414, 300 feet west and 50 feet south of the crossing of North Fork Barnett Creek and a county road, on soil map sheet 16, east-west 1,634,000 feet and north-south 442,000 feet by Kentucky grid coordinates:

Ap—0 to 8 inches; dark brown (10YR 4/3) silt loam; weak fine granular structure; very friable; many fine roots; neutral; abrupt smooth boundary.

C1—8 to 12 inches; brown (10YR 5/3) silt loam; few fine faint yellowish brown mottles and common medium distinct light gray (10YR 7/2) mottles; massive; very friable; common fine roots; strongly acid; clear smooth boundary.

C2—12 to 40 inches; light brownish gray (10YR 6/2) silt loam; common fine distinct yellowish brown (10YR 5/6) mottles; massive; very friable; strongly acid; gradual wavy boundary.

Cg—40 to 65 inches; gray (10YR 6/1) silt loam; common medium distinct yellowish brown (10YR 5/4) mottles; massive; very friable; very strongly acid.

The depth to bedrock is more than 60 inches. The soil is strongly acid or very strongly acid throughout except in areas that have been limed.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4.

The C horizon is mottled in shades of brown and gray. The C1 horizon has dominant colors in hue of 10YR, value of 4 or 5, and chroma of 3 to 6. Mottles are in hue of 10YR or 2.5YR, value of 4 to 7, and chroma of 1 or 2. The C2 horizon has similar colors except the chroma of 1 or 2 is dominant. The depth to those of the C2 horizon ranges from 10 to 20 inches.

The Cg horizon has colors similar to those of the C2 horizon.

Weinbach Series

The Weinbach series consists of deep, somewhat poorly drained soils that have a fragipan. Permeability is slow. The Weinbach soils formed in alluvium on stream terraces in the Green River and Rough River valleys. Slope is mostly less than 2 percent but ranges up to 4 percent.

Weinbach soils are associated with Elk and Otwell soils on stream terraces and Nolin, Lindside, Newark, and Melvin soils on flood plains. Elk and Otwell soils are better drained than Weinbach soils and do not have gray in the upper part of the subsoil. Elk soils do not have a fragipan. Nolin, Lindside, Newark, and Melvin soils do not have an argillic horizon or a fragipan.

Typical pedon of Weinbach silt loam; 2 miles east of McLean County line, 2 miles west of Heflin, and 200 feet south of Kentucky Highway 136, on soil map sheet 22, east-west 1,627,000 feet and north-south 428,000 feet by Kentucky grid coordinates:

Ap—0 to 9 inches; brown (10YR 4/3) silt loam; weak fine granular structure; very friable; common fine roots; medium acid; abrupt smooth boundary.

BA—9 to 22 inches; mottled light brownish gray (10YR 6/2) and yellowish brown (10YR 5/4) silt loam; weak fine and medium subangular blocky structure; few fine roots; many black concretionary stains; very friable; very strongly acid; abrupt wavy boundary.

Btx—22 to 40 inches; light brownish gray (10YR 6/2) silt loam; many medium distinct dark yellowish brown (10YR 4/4) mottles; weak coarse prismatic structure; firm, brittle and compact; a few patchy clay films on ped faces; very strongly acid; gradual smooth boundary.

BC—40 to 60 inches; mottled light brownish gray (10YR 6/2) and strong brown (7.5YR 5/6) silt loam; weak

coarse prismatic structure and weak fine subangular blocky structure; firm; very strongly acid.

The thickness of the solum ranges from 36 to 60 inches. Depth to bedrock is more than 72 inches. Depth to the fragipan ranges from 20 to 30 inches. Reaction is strongly acid or very strongly acid throughout except in areas that have been limed.

The Ap horizon is in hue of 10YR, value of 4, and chroma of 2 or 3.

The BA horizon is mottled in shades of gray and brown. It has hue of 10YR, value of 5 to 7, and chroma of 1 or 2, and hue of 10YR, value of 5 or 6, and chroma of 3 to 6.

The Btx horizon has dominant colors in hue of 10YR or 2.5Y, value of 5 to 7, and chroma of 1 or 2. Mottles are in hue of 7.5YR and 10YR, value of 4 and 5, and chroma of 4 to 6. Texture is silt loam or silty clay loam. The consistence is firm or very firm.

The BC horizon is mottled in shades of gray and brown. Texture is silt loam or silty clay loam.

Wellston Series

The Wellston series consists of deep, well drained soils that have moderate permeability. They formed in thin loess and the underlying residuum from capped sandstone and siltstone. Wellston soils are on side slopes and hilltops. Slope ranges from 6 to 50 percent.

Wellston soils are associated with Frondorf, Rosine, Sadler, Hosmer, Zanesville, and Calloway soils. Frondorf soils are not as deep to bedrock as Wellston soils. Rosine soils have more clay in the lower part of the subsoil. Sadler, Hosmer, Zanesville, and Calloway soils are not as well drained as Wellston soils, and they have a fragipan. Calloway soils have gray in the upper part of the subsoil.

Typical pedon of Wellston silt loam, 12 to 20 percent slopes, eroded; 1.5 miles south of Taffey on Highway 1414, 500 feet northwest of Clear Run Church, on soil map sheet 17, east-west 1,666,000 feet and north-south 441,000 feet by Kentucky grid coordinates:

A—0 to 2 inches; dark grayish brown (10YR 4/2) silt loam; weak fine granular structure; very friable; many fine fibrous roots; slightly acid; abrupt smooth boundary.

E—2 to 6 inches; brown (10YR 4/3) silt loam; weak fine granular structure; very friable; many fine and medium roots; slightly acid; abrupt smooth boundary.

Bt1—6 to 18 inches; brown (7.5YR 4/4) silt loam; weak fine subangular blocky structure; friable; common fine and medium roots; patchy clay films; medium acid; gradual wavy boundary.

Bt2—18 to 36 inches; brown (7.5YR 4/4) silt loam; moderate fine and medium subangular blocky structure; firm; few fine and medium roots; few pores and wormholes; few dark brown manganese stains; clay films on pores and ped surfaces; medium acid; gradual wavy boundary.

2Bt3—36 to 45 inches; dark yellowish brown (10YR 4/4) silt loam; few fine distinct light yellowish brown (10YR 6/4) mottles; moderate fine and medium subangular blocky structure; firm; thin very patchy clay films on pores and ped surfaces; strongly acid; gradual wavy boundary.

2C—45 to 65 inches; mottled yellowish brown (10YR 5/4) and gray (10YR 6/1) silt loam; weak fine and medium subangular blocky structure; firm; 15 percent sandstone fragments; strongly acid.

2R—65 inches; sandstone bedrock.

The thickness of the solum ranges from 32 to 50 inches. Depth to bedrock ranges from 40 to 72 inches. The content of coarse fragments ranges from 0 to 60 percent in the 2Bt3 and 2C horizons. Reaction is very strongly acid to medium acid throughout except in areas that have been limed.

The A horizon has hue of 10YR, value of 3 or 4, and chroma of 1 to 3.

Cultivated soils have an Ap horizon that has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. The E horizon has hue of 10YR, value of 4 to 6, and chroma of 3 or 4.

The Bt horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 4 to 6. In some pedons, the lower part of the Bt horizon has pale brown or light gray mottles. Texture is silt loam or silty clay loam. Structure is weak to strong, fine or medium. Consistence is friable or firm.

The 2C horizon has colors in shades of gray and brown and is mottled in most pedons. Texture is gravelly or channery loam, silt loam, or clay loam.

Zanesville Series

The Zanesville series consists of well drained to moderately well drained soils that have a fragipan and slow permeability. These soils formed in loess and underlying residuum from sandstone, siltstone, and shale. They are on ridgetops, side slopes, and toe slopes. Slope ranges from 2 to 12 percent.

Zanesville soils are associated with Wellston, Hosmer, Frondorf, Sadler, and Rosine soils. Wellston, Frondorf, and Rosine soils do not have a fragipan. Frondorf soils are not as deep to bedrock as Zanesville soils, and Hosmer soils are deeper to bedrock. Sadler soils have a bisequum. Rosine soils have more clay in the subsoil than Zanesville soils.

Typical pedon of Zanesville silt loam, 2 to 6 percent slopes, eroded; 6 miles east of Beaver Dam, 1.5 miles north of U.S. Highway 62, 0.6 mile north of Bethel Church, on soil map sheet 32, east-west 1,692,000 feet and north-south 410,000 feet by Kentucky grid coordinates:

Ap—0 to 9 inches; brown (10YR 4/3) silt loam; moderate fine granular structure; very friable; many fine and medium roots; slightly acid; clear smooth boundary.

Bt1—9 to 24 inches; strong brown (7.5YR 5/6) silt loam; moderate medium subangular blocky structure; firm; patchy clay films; few fine and medium roots; medium acid; gradual smooth boundary.

Bt2—24 to 30 inches; yellowish brown (10YR 5/6) silt loam; moderate fine subangular blocky structure; firm; patchy clay films; few fine roots; strongly acid; clear smooth boundary.

Btx—30 to 40 inches; yellowish brown (10YR 5/4) silt loam; many medium faint brown (7.5YR 4/4) mottles and common medium distinct light brownish gray (10YR 6/2) mottles; moderate very coarse prismatic structure parting to weak medium subangular blocky; firm, brittle and compact; few fine roots between prisms; gray silt loam between prisms; strongly acid; gradual smooth boundary.

2C1—40 to 60 inches; yellowish brown (10YR 5/4) loam; common medium distinct light brownish gray (10YR 6/2) mottles; massive; firm strongly acid; gradual smooth boundary.

2C2—60 to 65 inches; mottled yellowish brown (10YR 5/6) and red (2.5YR 4/6) clay loam; moderate medium subangular blocky structure; firm; many mica flakes; strongly acid.

2R—65 inches; sandstone.

The thickness of the solum ranges from 35 to 60 inches. Depth to bedrock ranges from 40 to 80 inches. Depth to the fragipan ranges from 20 to 32 inches. Reaction is strongly acid or very strongly acid throughout except in areas that have been limed.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. Forested soils have an A horizon that has value of 3 or 4 and chroma of 2 or 3, and they have an E horizon that has value of 4 to 6 and chroma of 3 or 4.

The Bt1 horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 6. The 10YR hue is mostly in the lower part of the horizon. Some pedons have mottles in the lower part of the Bt1 horizon. Texture is silt loam or silty clay loam. Structure is fine or medium. Consistence is friable or firm.

The Btx horizon has matrix colors in hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. Mottles and material in cracks between prisms are in hue of 10YR or 2.5Y, value of 4 to 7, and chroma of 1 or 2. Texture ranges from silty clay loam to loam.

The 2C horizon has colors and texture that are similar to those of the Bx horizon. The 2C horizon has 5 to 20 percent coarse fragments in some pedons.

Formation of the Soils

In this section, the processes of soil formation are discussed and related to the soils in the survey area.

Factors of Soil Formation

Soils formed through the interaction of climate, plant and animal life, parent material, relief, and time *(7)*. Climate and plant and animal life act on the parent material, and their effect is conditioned by relief and the length of time that they have been active.

All five factors were active in the formation of the soils of Ohio County. The relative importance of each differs from place to place and accounts for varying characteristics of the soils. In some places one factor is dominant in influencing the soil characteristics, and in other places another factor is dominant. Each factor modifies the effect of the other four.

The five factors and their effect on the soils of Ohio County are discussed in the following paragraphs.

Parent Material

Parent material is the unconsolidated mass of geologic material in which the soils formed. It varies widely and accounts for many of the differences in the soils. The parent material of soils in Ohio County is loess, alluvium, or residuum derived from bedrock.

Loess, a wind-deposited silt, is on most of the uplands. It ranges from about 6 feet on gentle slopes in the northwestern part of the county to 1 foot or less on steep slopes in the southern part of the county. Hosmer soils, which are mainly in the northern part of the county, formed in loess more than 4 feet thick.

Under the loess is interbedded sandstone, siltstone, shale, and limestone. The weathered upper part of the bedrock is residuum that is parent material of some of the soils. Most of the soils that formed where the loess is less than 4 feet thick formed partly in loess and partly in underlying residuum. Wellston, Frondorf, Zanesville, and Sadler soils formed in loess and the underlying residuum derived from sandstone and siltstone. Soils that formed in residuum derived from shale or limestone have a high content of clay. Rosine soils formed partly in residuum derived from shale. Caneyville soils formed mostly in residuum derived from limestone. These soils have a clayey subsoil.

The alluvium washed from the nearby uplands in the survey area or came down the rivers from outside the survey area. The alluvium in the narrow valleys has a high content of silt and came from the nearby loess-covered uplands. Cuba, Steff, Stendal, and Bonnie soils formed in alluvium that washed mostly from adjacent uplands.

The Green River and the Rough River, which have large drainage areas, have brought in alluvium from a variety of parent material. Soils in the river valleys, which have mixed parent material, are Elk, Otwell, Henshaw, Nolin, Lindside, Newark, and Melvin soils. The river valleys also have soils that formed in alluvium deposited in slack water. Such soils, which contain a high content of clay, are Karnak and McGary soils.

Climate

The climate of Ohio County is humid and temperate. Generally, summers are warm, winters are cool, and precipitation is distributed throughout the year. Presumably, the present climate is similar to the climate that was in this area during the time the soils formed.

Climate affects the erosion, the weathering of geologic material, and the kind and number of plants and animals. Water from rainfall alters the geologic material as it runs off or percolates through the soil. In soils on uplands, such as Zanesville and Wellston soils, water has leached soluble bases from the soils and moved clays from upper layers to lower layers. Water and temperature affect the growth of plant and animal life, mostly in wet, warm seasons.

Because soils in this survey area are neither frozen nor dry for long periods, soil-forming processes are active throughout the year. However, because the climate is uniform throughout the survey area, factors other than climate caused the differences in the soils.

Plant and Animal Life

Plants and animals are active in soil formation in Ohio County. They add organic matter, especially to the surface layer. Bacteria and fungi decay the organic matter and release plant nutrients. Plant roots penetrate the subsoil and obtain plant nutrients. The plants then die and add organic matter and plant nutrients to the surface soil. Animals, such as moles, mice, groundhogs, and crayfish, burrow through and mix the soils. Many forms of small animal life, such as earthworms, grubs,

and insects, live in and on the soil and alter it. Plants generally have influenced soils more than animals.

The native vegetation of the area was hardwood forests. The older soils, such as Zanesville and Wellston soils, have characteristics that are typical of soils that formed under hardwood forests. These soils are acid, and they have a thin, dark surface layer; a leached subsurface layer; and a subsoil that has more clay than either the surface layer or the substratum.

Man has altered the soil by removing trees and mixing the surface layer into a plow layer. In a few places, man has leveled or graded the soil or even mixed the soil with the underlying bedrock. Man also has accelerated erosion on uplands and increased deposition on the flood plains. Nevertheless, except for altering the surface layer, man's influence on soil formation has been minor in most places.

Relief

Relief influences the soils and is responsible for many of the differences in the soils in the survey area. It affects drainage, erosion, plant cover, soil temperature, and depth of soil. In Ohio County, relief ranges from nearly level to steep.

Most nearly level soils are somewhat poorly drained or poorly drained, most gently sloping soils are moderately well drained, and most sloping to steep soils are well drained. Soils that have excess water for long periods of time have a gray subsoil that is characteristic of poorly drained or somewhat poorly drained soils. Bonnie soils are poorly drained, and Stendal soils are somewhat poorly drained. Soils that have a subsoil that is mostly brown and has a few gray mottles are moderately well drained. Lindside and Sadler soils are moderately well drained. Most soils that have a brown subsoil are well drained. Wellston and Nolin soils are well drained.

The fragipan, a characteristic of some soils that have impeded drainage, forms only in soils that are mainly nearly level to sloping. Soils that have a fragipan are on stream terraces or uplands and are higher than adjacent soils. Calloway, Hosmer, Otwell, Sadler, and Zanesville soils have a fragipan.

Relief also affects the thickness of loess on the uplands. The loess is thicker on gentle slopes than it is on steeper slopes. Some soils that are gently sloping, such as Hosmer soils, formed in loess. Soils that are strongly sloping to steep formed either in loess and residuum or entirely in residuum. Wellston, Rosine, and Frondorf soils formed in loess and residuum, and Caneyville soils formed in residuum. Some strongly sloping to steep soils, such as Frondorf and Caneyville soils, are not as deep to bedrock as most soils in the survey area.

The direction of slope slightly affects soil temperature and plant cover. Because south-facing slopes freeze and thaw more frequently than north-facing slopes, south-facing slopes are subject to slightly more weathering and erosion. Plant cover also differs slightly on north-facing and south-facing slopes. The difference in soil temperature and plant cover caused by slope have not greatly affected soil formation, however.

Time

The length of time that soil-forming processes have been active determines the amount of profile development. Generally, an old soil has a well developed soil profile, and a young soil has a weakly developed profile. A well developed soil profile has distinct soil horizons. Soil profiles in Ohio County range from well developed to weakly developed.

Soils that formed in residuum are the oldest soils in the survey area, and soils that, formed in loess are the next oldest. Most of the soils on uplands formed partly in loess and have a well developed soil profile. The loess dates from near the end of the ice age, and presumably these soils have been forming for thousands of years. Wellston, Zanesville, and Caneyville soils are examples of soils that have a well developed profile.

Most soils that formed on stream terraces in the Green River Valley also have a well developed soil profile. These soils are as old or almost as old as the soils that formed in loess *(12)*. Elk, Otwell, and McGary soils are examples of these soils.

Soils that formed in recent alluvium on flood plains are mainly young soils. Stendal, Steff, Nolin, and Lindside soils are young soils that have a weakly developed soil profile.

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Glossary

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well-aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 40-inch profile or to a limiting layer is expressed as—

	Inches
Very low	ess than 2.4
Low	2.4 to 3.2
Moderate	3.2 to 5.2
High	more than 5.2

Base saturation. The degree to which material having cation-exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, K), expressed as a percentage of the total cation-exchange capacity.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Bisequum. Two sequences of soil horizons, each of which consists of an illuvial horizon and the overlying eluvial horizons.

Bottom land. The normal flood plain of a stream, subject to flooding.

Boulders. Rock fragments larger than 2 feet (60 centimeters) in diameter.

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

Capillary water. Water held as a film around soil particles and in tiny spaces between particles. Surface tension is the adhesive force that holds capillary water in the soil.

Cation. An ion carrying a positive charge of electricity. The common soil cations are calcium, potassium, magnesium, sodium, and hydrogen.

Cation-exchange capacity. The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity, but is more precise in meaning.

Channery soil. A soil that is, by volume, more than 15 percent thin, flat fragments of sandstone, shale, slate, limestone, or schist as much as 6 inches along the longest axis. A single piece is called a fragment.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

Coarse fragments. If round, mineral or rock particles 2 millimeters to 25 centimeters (10 inches) in diameter; if flat, mineral or rock particles (flagstone) 15 to 38 centimeters (6 to 15 inches) long.

Coarse textured soil. Sand or loamy sand.

Complex, soil. A map unit of two or more kinds of soil in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils are somewhat similar in all areas.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

Conservation tillage. A form of noninversion tillage that retains protective amounts of residue mulch on the surface throughout the year. These include no

tillage, strip tillage, stubble mulching, and other types of noninversion tillage.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—
Loose.—Noncoherent when dry or moist; does not hold together in a mass.
Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.
Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.
Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.
Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.
Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.
Soft.—When dry, breaks into powder or individual grains under very slight pressure.
Cemented.—Hard; little affected by moistening.

Contour stripcropping. Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

Corrosive. High risk of corrosion to uncoated steel or deterioration of concrete.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

Depth to rock (in tables). Bedrock is too near the surface for the specified use.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:
Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.
Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.
Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.
Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically they are wet long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.
Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.
Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.
Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients.

Drainage, surface. Runoff, or surface flow of water, from an area.

Eluviation. The movement of material in true solution or colloidal suspension from one place to another within the soil. Soil horizons that have lost material through eluviation are eluvial; those that have received material are illuvial.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.
Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.
Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, such as fire, that exposes the surface.

Excess sodium (in tables). Excess exchangeable sodium is in the soil. The resulting poor physical properties restrict the growth of plants.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the ovendry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity, normal moisture capacity,* or *capillary capacity.*

Fine textured soil. Sandy clay, silty clay, and clay.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Fragipan. A loamy, brittle subsurface horizon low in porosity and content of organic matter and low or moderate in clay but high in silt or very fine sand. A fragipan appears cemented and restricts roots. When dry, it is hard or very hard and has a higher bulk density than the horizon or horizons above. When moist, it tends to rupture suddenly under pressure rather than to deform slowly.

Frost action (in tables). Freezing and thawing of soil moisture. Soil moisture can damage roads, buildings and other structures, and plant roots.

Genesis, soil. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Gleyed soil. Soil that formed under poor drainage, resulting in the reduction of iron and other elements in the profile and in gray colors and mottles.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.5 centimeters) in diameter. An individual piece is a pebble.

Green-manure crop (agronomy). A soil-improving crop grown to be plowed under in an early stage of maturity or soon after maturity.

Ground water (geology). Water filling all the unblocked pores of underlying material below the water table.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an upper case letter represents the major horizons. Numbers or lower case letters that follow represent subdivisions of the major horizons. An explanation of the subdivisions is given in the *Soil Survey Manual.* The major horizons of mineral soil are as follows:
O horizon.—An organic layer of fresh and decaying plant residue at the surface of a mineral soil.
A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon, most of which was originally part of a B horizon.
E horizon.—The mineral horizon in which the main feature is loss of silicate clay, iron, aluminum, or some combination of these.
B horizon.—The mineral horizon below an O, A, or E horizon. The B horizon is, in part, a layer of transition from the overlying horizon to the underlying C horizon. The B horizon also has distinctive characteristics, such as accumulation of clay, sesquioxides, humus, or a combination of these; prismatic or blocky structure; redder or browner colors than those in the A horizon; or a combination of these. The combined A and B horizons are generally called the solum, or true soil. If a soil does not have a B horizon, the A horizon alone is the solum.
C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the A or B horizon. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, the Arabic numeral 2 precedes the letter C.

R layer.—Consolidated rock (unweathered bedrock) beneath the soil. The rock commonly underlies a C horizon, but can be directly below an A or a B horizon.

Humus. The well decomposed, more or less stable part of the organic matter in mineral soils.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Illuviation. The movement of soil material from one horizon to another in the soil profile. Generally, material is removed from an upper horizon and deposited in a lower horizon.

Infiltration. The downward entry of water into the immediate surface of soil or other material. This contrasts with percolation, which is movement of water through soil layers or material.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Karst (topography). The relief of an area underlain by limestone that dissolves in differing degrees, thus forming numerous depressions or small basins.

Large stones (in tables). Rock fragments that are 3 inches (7.5 centimeters) or more across. Large stones adversely affect the specified use of the soil.

Leaching. The removal of soluble material from soil or other material by percolating water.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Loess. Fine grained material, dominantly of silt-sized particles, deposited by wind.

Low strength. The soil is not strong enough to support loads.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Miscellaneous area. An area that has little or no natural soil and supports little or no vegetation.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—*few, common,* and *many*; size—*fine, medium,* and *coarse*; and contrast—*faint, distinct,* and *prominent*. The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium*, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse*, more than 15 millimeters (about 0.6 inch).

Munsell notation. A designation of color by degrees of the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color of 10YR hue, value of 6, and chroma of 4.

Neutral soil. A soil having a pH value between 6.6 and 7.3. (See Reaction, soil.)

Nutrient, plant. Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.

Organic matter. Plant and animal residue in the soil in various stages of decomposition.

Pan. A compact, dense layer in a soil that impedes the movement of water and the growth of roots. For example, *hardpan, fragipan, claypan, plowpan,* and *traffic pan*.

Parent material. The unconsolidated organic and mineral material in which soil forms.

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The downward movement of water through the soil.

Percs slowly (in tables). The slow movement of water through the soil adversely affects the specified use.

Permeability. The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves downward through the saturated soil. Terms describing permeability are:

Very slow	less than 0.06 inch
Slow	0.06 to 0.2 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

Phase, soil. A subdivision of a soil series based on features that affect its use and management. For example, slope, stoniness, and thickness.

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Piping (in tables). Subsurface tunnels or pipelike cavities are formed by water moving through the soil.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Plowpan. A compacted layer formed in the soil directly below the plowed layer.

Ponding. Standing water on soils in closed depressions. Unless the soils are artificially drained, the water can be removed only by percolation or evapotranspiration.

Poorly graded. Refers to a coarse grained soil or soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

Poor outlets (in tables). In these areas, surface or subsurface drainage outlets are difficult or expensive to install.

Productivity, soil. The capability of a soil for producing a specified plant or sequence of plants under specific management.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Reaction, soil. A measure of the acidity or alkalinity of a soil expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as—

	pH
Extremely acid	below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Relief. The elevations or inequalities of a land surface, considered collectively.

Residuum (residual soil material). Unconsolidated, weathered, or partly weathered mineral material that accumulated as consolidated rock disintegrated in place.

Rill. A steep sided channel resulting from accelerated erosion. A rill is generally a few inches deep and not wide enough to be an obstacle to farm machinery.

Rippable. Rippable bedrock or hardpan can be excavated using a single-tooth ripping attachment mounted on a tractor with a 200-300 draw bar horsepower rating.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Rooting depth (in tables). There is a shallow root zone. The soil is shallow over a layer that greatly restricts roots.

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sandstone. Sedimentary rock containing dominantly sand-size particles.

Sedimentary rock. Rock made up of particles deposited from suspension in water. The chief kinds of sedimentary rock are conglomerate, formed from gravel; sandstone, formed from sand; shale, formed from clay; and limestone, formed from soft masses of calcium carbonate. There are many intermediate types. Some wind-deposited sand is consolidated into sandstone.

Seepage (in tables). The movement of water through the soil adversely affects the specified use.

Sequum. A sequence consisting of an illuvial horizon and the overlying eluvial horizon. (See Eluviation.)

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the underlying material. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

Sheet erosion. The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and surface runoff.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Siltstone. Sedimentary rock made up of dominantly silt-sized particles.

Site index. A designation of the quality of a forest site based on the height of the dominant stand at an arbitrarily chosen age. For example, if the average height attained by dominant and codominant trees in a fully stocked stand at the age of 50 years is 75 feet, the site index is 75 feet.

Slickensides. Polished and grooved surfaces produced by one mass sliding past another. In soils, slickensides may occur at the bases of slip surfaces on the steeper slopes; on faces of blocks, prisms, and columns; and in swelling clayey soils, where there is marked change in moisture content.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Slope (in tables). Slope is great enough that special practices are required to ensure satisfactory performance of the soil for a specific use.

Small stones (in tables). Rock fragments less than 3 inches (7.5 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows:

	Millimeters
Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A, E, and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and plant and animal activities are largely confined to the solum.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter.

Stripcropping. Growing crops in a systematic arrangement of strips or bands that provide vegetative barriers to wind and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grained* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. The part of the soil below the solum.

Subsurface layer. Technically, the A2 horizon. Generally refers to a leached horizon lighter in color and lower in organic matter content than the overlying surface layer.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use and behavior.

Terrace. An embankment, or ridge, constructed on the contour or at a slight angle to the contour across sloping soils. The terrace intercepts surface runoff, so that water soaks into the soil or flows slowly to a prepared outlet.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer (in tables). An otherwise suitable soil material that is too thin for the specified use.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Variegation. Refers to patterns of contrasting colors that are assumed to be inherited from the parent material rather than to be the result of poor drainage.

Tables

TABLE 1.--TEMPERATURE AND PRECIPITATION

[Recorded in the period 1951-80 at Beaver Dam, Kentucky]

Month	Temperature						Precipitation				
	Average daily maximum	Average daily minimum	Average daily	2 years in 10 will have-- Maximum temperature higher than--	2 years in 10 will have-- Minimum temperature lower than--	Average number of growing degree days*	Average	2 years in 10 will have-- Less than--	2 years in 10 will have-- More than--	Average number of days with 0.10 inch or more	Average snowfall
	°F	°F	°F	°F	°F	Units	In	In	In		In
January----	43.7	24.2	34.0	71	-10	22	3.85	1.97	5.48	7	1.8
February---	48.8	27.0	37.9	74	-3	30	3.55	1.63	5.18	6	1.7
March------	58.4	35.5	47.0	83	10	117	4.61	2.41	6.53	8	.1
April------	70.8	45.7	58.3	88	25	259	4.05	2.01	5.81	7	.0
May--------	78.9	53.5	66.2	91	31	502	4.61	2.47	6.48	7	.0
June-------	86.1	61.8	74.0	98	45	720	3.60	1.79	5.16	6	.0
July-------	86.8	65.4	77.1	98	50	840	4.19	1.85	6.18	7	.0
August-----	88.1	63.9	76.0	98	49	806	3.00	1.52	4.27	5	.0
September--	82.4	57.2	69.8	96	39	594	3.49	1.45	5.21	5	.0
October----	71.9	44.7	58.3	88	23	273	2.42	1.03	3.61	4	.0
November---	58.1	35.6	46.9	81	12	49	3.84	1.72	5.64	6	.4
December---	47.9	28.5	38.2	71	1	19	3.85	1.81	5.60	7	.6
Yearly:											
Average--	68.7	45.3	57.0	---	---	---	---	---	---	---	---
Extreme--	---	---	---	100	-13	---	---	---	---	---	---
Total----	---	---	---	---	---	4,231	45.06	37.20	52.51	75	4.6

* A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (50 °F).

TABLE 2.--FREEZE DATES IN SPRING AND FALL

[Recorded in the period 1951-80
at Beaver Dam, Kentucky]

Probability	Temperature		
	24 °F or lower	28 °F or lower	32 °F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	April 6	April 20	May 10
2 years in 10 later than--	March 31	April 15	May 3
5 years in 10 later than--	March 21	April 5	April 21
First freezing temperature in fall:			
1 year in 10 earlier than--	October 25	October 9	September 30
2 years in 10 earlier than--	October 30	October 14	October 5
5 years in 10 earlier than--	November 8	October 26	October 14

TABLE 3.--GROWING SEASON

[Recorded in the period 1951-80
at Beaver Dam, Kentucky]

Probability	Daily minimum temperature during growing season		
	Higher than 24 °F	Higher than 28 °F	Higher than 32 °F
	Days	Days	Days
9 years in 10	211	184	157
8 years in 10	218	190	163
5 years in 10	231	203	176
2 years in 10	244	215	189
1 year in 10	251	222	195

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
BfF	Bethesda, Fairpoint, and Morristown soils, 20 to 70 percent slopes	11,650	3.1
Bo	Bonnie silt loam, occasionally flooded	9,000	2.4
Bp	Bonnie silt loam, ponded	610	0.2
Ca	Calloway silt loam	700	0.2
CcD2	Caneyville silt loam, very rocky, 8 to 20 percent slopes, eroded	90	*
Ct	Clifty gravelly silt loam, occasionally flooded	3,820	1.0
Cu	Cuba silt loam, occasionally flooded	2,390	0.6
Du	Dumps, mine	100	*
EkA	Elk silt loam, 0 to 2 percent slopes	120	*
EkB2	Elk silt loam, 2 to 6 percent slopes, eroded	200	0.1
FbB	Fairpoint, Bethesda, and Morristown silt loams, 0 to 6 percent slopes	900	0.2
FbD	Fairpoint, Bethesda, and Morristown silt loams, 6 to 20 percent slopes	1,960	0.5
FmB	Fairpoint, Bethesda, and Morristown soils, 0 to 6 percent slopes	1,120	0.3
FmD	Fairpoint, Bethesda, and Morristown soils, 6 to 20 percent slopes	7,030	1.8
FrF	Frondorf-Wellston silt loams, 30 to 50 percent slopes	16,500	4.3
FsD2	Frondorf-Wellston-Rosine silt loams, 12 to 20 percent slopes, eroded	38,190	10.0
FsE	Frondorf-Wellston-Rosine silt loams, 20 to 30 percent slopes	46,752	12.3
FwD3	Frondorf-Wellston-Rosine complex, 12 to 20 percent slopes, severely eroded	11,800	3.1
FwE3	Frondorf-Wellston-Rosine complex, 20 to 30 percent slopes, severely eroded	1,910	0.5
He	Henshaw silt loam	2,220	0.6
HoB2	Hosmer silt loam, 2 to 6 percent slopes, eroded	8,460	2.2
Ka	Karnak silt loam, overwash, occasionally flooded	1,090	0.3
Kc	Karnak silty clay, occasionally flooded	4,170	1.1
Ld	Lindside silt loam, occasionally flooded	3,680	1.0
Mc	McGary silt loam	1,050	0.3
Me	Melvin silt loam, occasionally flooded	11,410	3.0
Ne	Newark silt loam, occasionally flooded	11,790	3.1
No	Nolin silt loam, occasionally flooded	4,170	1.1
OtA	Otwell silt loam, 0 to 2 percent slopes	1,060	0.3
OtB2	Otwell silt loam, 2 to 6 percent slopes, eroded	750	0.2
Pi	Pits, quarry	170	*
Po	Pope fine sandy loam, occasionally flooded	620	0.2
RcC2	Rosine and Caneyville silt loams, 6 to 12 percent slopes, eroded	140	*
RcD2	Rosine and Caneyville silt loams, 12 to 20 percent slopes, eroded	150	*
RoC3	Rosine and Caneyville soils, 6 to 12 percent slopes, severely eroded	110	*
RoD3	Rosine and Caneyville soils, 12 to 20 percent slopes, severely eroded	470	0.1
SaB2	Sadler silt loam, 2 to 6 percent slopes, eroded	15,650	4.1
Sf	Steff silt loam, occasionally flooded	11,740	3.1
Sn	Stendal silt loam, occasionally flooded	35,710	9.4
Wb	Weinbach silt loam	2,020	0.5
WeC2	Wellston silt loam, 6 to 12 percent slopes, eroded	15,410	4.0
WeC3	Wellston silt loam, 6 to 12 percent slopes, severely eroded	6,560	1.7
WeD2	Wellston silt loam, 12 to 20 percent slopes, eroded	18,600	4.9
WeD3	Wellston silt loam, 12 to 20 percent slopes, severely eroded	12,010	3.1
ZaB2	Zanesville silt loam, 2 to 6 percent slopes, eroded	15,440	4.1
ZaC2	Zanesville silt loam, 6 to 12 percent slopes, eroded	36,390	9.5
ZaC3	Zanesville silt loam, 6 to 12 percent slopes severely eroded	5,500	1.4
	Water	192	0.1
	Total	381,574	100.0

* Less than 0.1 percent.

TABLE 5.--PRIME FARMLAND

[Only the soils considered prime farmland are listed. Urban or built-up areas of the soils listed are not considered prime farmland. If a soil is prime farmland only under certain conditions, the conditions are specified in parentheses after the soil name]

Map symbol	Soil name
Bo	Bonnie silt loam, occasionally flooded (where drained)
Ca	Calloway silt loam
Ct	Clifty gravelly silt loam, occasionally flooded
Cu	Cuba silt loam, occasionally flooded
EkA	Elk silt loam, 0 to 2 percent slopes
EkB2	Elk silt loam, 2 to 6 percent slopes, eroded
He	Henshaw silt loam
HoB2	Hosmer silt loam, 2 to 6 percent slopes, eroded
Ka	Karnak silt loam, overwash, occasionally flooded (where drained)
Kc	Karnak silty clay, occasionally flooded (where drained)
Ld	Lindside silt loam, occasionally flooded
Mc	McGary silt loam (where drained)
Me	Melvin silt loam, occasionally flooded (where drained)
Ne	Newark silt loam, occasionally flooded (where drained)
No	Nolin silt loam, occasionally flooded
OtA	Otwell silt loam, 0 to 2 percent slopes
OtB2	Otwell silt loam, 2 to 6 percent slopes, eroded
Po	Pope fine sandy loam, occasionally flooded
SaB2	Sadler silt loam, 2 to 6 percent slopes, eroded
Sf	Steff silt loam, occasionally flooded
Sn	Stendal silt loam, occasionally flooded (where drained)
Wb	Weinbach silt loam (where drained)
ZaB2	Zanesville silt loam, 2 to 6 percent slopes, eroded

TABLE 6.--LAND CAPABILITY CLASSES AND YIELDS PER ACRE OF CROPS AND PASTURE

[Yields are those that can be expected under a high level of management. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil]

Map symbol and soil name	Land capability	Corn	Wheat	Soybeans	Tobacco	Grass-legume hay	Pasture
		Bu	Bu	Bu	Lbs	Tons	AUM*
BfF--- Bethesda, Fairpoint, and Morristown	VIIe	---	---	---	---	---	---
Bo--- Bonnie	IIIw	100	---	37	---	4.0	7.0
Bp--- Bonnie	Vw	---	---	---	---	---	---
Ca--- Calloway	IIw	95	---	40	---	4.0	7.0
CcD2--- Caneyville	VIs	---	---	---	---	---	2.5
Ct--- Clifty	IIs	110	35	35	2,500	4.0	8.0
Cu--- Cuba	IIw	120	41	37	---	4.0	8.5
Du--- Dumps	VIIIs	---	---	---	---	---	---
EkA--- Elk	I	130	45	45	3,200	4.5	9.0
EkB2--- Elk	IIe	125	45	45	3,200	4.5	9.0
FbB--- Fairpoint, Bethesda, and Morristown	IVs	---	---	---	---	2.5	5.5
FbD--- Fairpoint, Bethesda, and Morristown	VIs	---	---	---	---	1.9	4.5
FmB, FmD--- Fairpoint, Bethesda, and Morristown	VIs	---	---	---	---	1.0	3.1
FrF--- Frondorf-Wellston	VIIe	---	---	---	---	---	---
FsD2--- Frondorf-Wellston-Rosine	IVe	85	---	---	---	3.1	6.0

See footnote at end of table.

TABLE 6.--LAND CAPABILITY CLASSES AND YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Map symbol and soil name	Land capability	Corn	Wheat	Soybeans	Tobacco	Grass-legume hay	Pasture
		Bu	Bu	Bu	Lbs	Tons	AUM*
FsE---- Frondorf-Wellston-Rosine	VIe	---	---	---	---	2.6	5.0
FwD3---- Frondorf-Wellston-Rosine	VIe	---	---	---	---	2.8	5.6
FwE3:							
Frondorf----	VIIe	---	---	---	---	---	4.5
Wellston----	VIe	---	---	---	---	---	4.5
Rosine----	VIIe	---	---	---	---	---	4.5
He---- Henshaw	IIw	115	50	50	---	4.5	8.0
HoB2---- Hosmer	IIe	95	40	33	2,550	4.0	8.0
Ka, Kc---- Karnak	IIIw	95	---	25	---	3.5	7.5
Ld---- Lindside	IIw	125	40	45	2,800	3.5	8.5
Mc---- McGary	IIIw	90	---	35	---	3.0	6.0
Me---- Melvin	IIIw	95	---	35	---	3.5	7.0
Ne---- Newark	IIw	100	35	40	---	4.5	8.5
No---- Nolin	IIw	115	41	38	2,700	4.0	9.0
OtA---- Otwell	IIw	105	40	37	2,800	3.4	7.5
OtB2---- Otwell	IIe	95	40	33	2,800	3.1	7.5
Pi---- Pits	VIIs	---	---	---	---	---	---
Po---- Pope	IIw	105	35	35	2,200	3.5	7.0
RcC2:							
Rosine----	IIIe	90	---	30	---	3.9	7.3
Caneyville----	IVe	90	---	30	---	3.9	7.3

See footnote at end of table.

TABLE 6.--LAND CAPABILITY CLASSES AND YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Map symbol and soil name	Land capability	Corn	Wheat	Soybeans	Tobacco	Grass-legume hay	Pasture
		Bu	Bu	Bu	Lbs	Tons	AUM*
RcD2:							
Rosine	IVe	---	---	---	---	3.0	6.4
Caneyville	VIe	---	---	---	---	3.0	6.4
RoC3:							
Rosine	IVe	---	---	---	---	2.5	6.5
Caneyville	VIe	---	---	---	---	2.5	6.5
RoD3 Rosine and Caneyville	VIe	---	---	---	---	2.0	5.0
SaB2 Sadler	IIe	105	40	40	2,550	3.5	7.0
Sf Steff	IIw	120	45	45	---	4.0	9.0
Sn Stendal	IIw	110	---	38	---	3.7	8.0
Wb Weinbach	IIw	110	---	38	---	3.6	7.0
WeC2 Wellston	IIIe	100	40	35	2,800	4.0	7.5
WeC3 Wellston	IVe	90	30	---	---	3.5	6.5
WeD2 Wellston	IVe	95	---	---	---	3.5	7.0
WeD3 Wellston	VIe	---	---	---	---	3.0	6.0
ZaB2 Zanesville	IIe	105	40	35	2,500	3.5	7.0
ZaC2 Zanesville	IIIe	100	35	30	2,300	3.5	6.5
ZaC3 Zanesville	IVe	80	25	20	---	3.0	5.5

* Animal-unit-month: The amount of forage or feed required to feed one animal unit (one cow, one horse, one mule, five sheep, or five goats) for 30 days.

TABLE 7.--CAPABILITY CLASSES AND SUBCLASSES

[Water areas larger than 40 acres are excluded.
Absence of an entry indicates no acreage]

Class	Total acreage	Major management concerns (Subclass)		
		Erosion (e) Acres	Wetness (w) Acres	Soil problem (s) Acres
I	120	---	---	---
II	120,420	40,500	76,100	3,820
III	78,620	51,900	26,720	---
IV	69,960	69,060	---	900
V	610	---	610	---
VI	81,802	71,602	---	10,200
VII	29,750	29,580	---	170
VIII	100	---	---	100

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY

[Only the soils suitable for production of commercial trees are listed. Absence of an entry indicates that information was not available]

Map symbol and soil name	Ordination symbol	Management concerns				Potential productivity		Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Plant competition	Common trees	Site index	
BfF:								
Bethesda------	4r	Severe	Severe	Moderate	Slight	Loblolly pine-----	69	Eastern white pine, black locust, loblolly pine.
						Eastern cottonwood	---	
						Black locust------	---	
						Sweetgum----------	---	
Fairpoint-----	3r	Severe	Severe	Moderate	Moderate	Loblolly pine-----	78	Eastern white pine, black locust, yellow-poplar, loblolly pine.
						Sweetgum----------	---	
						Black locust------	---	
Morristown----	4r	Severe	Severe	Severe	Slight	Loblolly pine-----	68	Eastern white pine, black locust, loblolly pine.
						Sweetgum----------	---	
						Black locust------	---	
						American sycamore-	---	
Bo---------- Bonnie	2w	Slight	Severe	Moderate	Moderate	Pin oak----------	90	Eastern cottonwood, American sycamore, sweetgum, baldcypress, pin oak.
						Eastern cottonwood	100	
						Sweetgum----------	100	
						Cherrybark oak----	---	
						American sycamore-	---	
Bp---------- Bonnie	4w	Slight	Severe	Severe	Severe	Pin oak----------	90	Baldcypress, sweetgum, pin oak.
						Eastern cottonwood	---	
						Red maple---------	---	
						American sycamore-	---	
						Black willow------	---	
Ca---------- Calloway	2w	Slight	Moderate	Slight	Moderate	Cherrybark oak----	90	Cherrybark oak, eastern white pine, sweetgum, yellow-poplar, loblolly pine.
						Yellow-poplar-----	91	
						Southern red oak--	84	
						Sweetgum----------	90	
						Blackgum----------	---	
						White oak---------	---	
CcD2:								
Caneyville---- (north slopes)	3x	Moderate	Moderate	Moderate	Moderate	Black oak---------	71	White oak, yellow-poplar, eastern white pine, white ash.
						Yellow-poplar-----	90	
						Eastern redcedar--	46	
						White oak---------	64	
						Sugar maple-------	---	
						Hickory-----------	---	
Caneyville---- (south slopes)	4x	Moderate	Moderate	Moderate	Slight	Black oak---------	65	Virginia pine, eastern redcedar.
						White oak---------	52	
						Sugar maple-------	---	
						Hickory-----------	---	
						Eastern redcedar--	36	
						Chinkapin oak-----	51	
						Scarlet oak-------	53	
Ct---------- Clifty	2o	Slight	Slight	Slight	Moderate	Shortleaf pine----	76	Yellow-poplar, sweetgum, white ash, shortleaf pine, white oak, eastern white pine, northern red oak, loblolly pine.
						Yellow-poplar-----	---	
						Virginia pine-----	---	
						White oak---------	64	
						Northern red oak--	---	
						American beech----	---	
						American sycamore-	---	

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Map symbol and soil name	Ordination symbol	Management concerns				Potential productivity		Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Plant competition	Common trees	Site index	
Cu---------- Cuba	1o	Slight	Slight	Slight	Severe	Yellow-poplar-----	100	Eastern white pine, black walnut, yellow-poplar, white oak, northern red oak, shortleaf pine, white ash, loblolly pine.
						Sweetgum----------	---	
						Virginia pine-----	---	
						American elm------	---	
						Blackgum----------	---	
EkA, EkB2------ Elk	2o	Slight	Slight	Slight	Moderate	Cherrybark oak----	95	Eastern white pine, shortleaf pine, yellow-poplar, black walnut, loblolly pine, white oak, white ash, cherrybark oak.
						Yellow-poplar-----	91	
						Pin oak-----------	96	
						Hackberry---------	---	
						Red maple---------	---	
						American sycamore-	---	
FbB, FdD, FmB, FmD: Fairpoint----	3r	Moderate	Moderate	Moderate	Moderate	Loblolly pine-----	78	Eastern white pine, black locust, yellow-poplar, loblolly pine.
						Sweetgum----------	---	
						Black locust------	---	
Bethesda-----	4r	Moderate	Moderate	Moderate	Moderate	Loblolly pine-----	69	Eastern white pine, black locust, loblolly pine.
						Eastern cottonwood	---	
						Black locust------	---	
						Sweetgum----------	---	
Morristown---	4r	Moderate	Moderate	Moderate	Moderate	Loblolly pine-----	68	Eastern white pine, black locust, yellow-poplar, loblolly pine.
						Sweetgum----------	---	
						Black locust------	---	
						American sycamore-	---	
FrF: Frondorf------ (north slopes)	2r	Severe	Severe	Slight	Moderate	Black oak---------	82	Yellow-poplar, white ash, shortleaf pine, eastern white pine, loblolly pine, northern red oak.
						White oak---------	74	
						Yellow-poplar-----	---	
						Hickory-----------	---	
						White ash---------	---	
						Virginia pine-----	70	
Wellston------ (north slopes)	2r	Severe	Severe	Slight	Moderate	Northern red oak--	74	Eastern white pine, black walnut, yellow-poplar, white oak, northern red oak, white ash, shortleaf pine, loblolly pine.
						Yellow-poplar-----	90	
						Virginia pine-----	67	
						White oak---------	82	
						Black walnut------	---	
						Black cherry------	---	
						Sugar maple-------	---	
						White ash---------	---	
						Black oak---------	80	
						Hickory-----------	---	
						Shortleaf pine----	75	
						Chestnut oak------	78	
Frondorf------ (south slopes)	3r	Severe	Severe	Moderate	Moderate	Black oak---------	75	Shortleaf pine, white oak, loblolly pine.
						White oak---------	68	
						Post oak----------	73	
						Scarlet oak-------	---	

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Map symbol and soil name	Ordination symbol	Management concerns				Potential productivity		Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Plant competition	Common trees	Site index	
FrF:								
Wellston------ (south slopes)	3r	Severe	Severe	Moderate	Moderate	Black oak---------	---	Eastern white pine, white oak, shortleaf pine, loblolly pine.
						Virginia pine-----	---	
						White oak---------	74	
						Sugar maple-------	---	
						Shortleaf pine----	---	
						Chestnut oak------	---	
						Post oak----------	---	
FsD2, FsE:								
Frondorf------ (north slopes)	2r	Moderate	Moderate	Slight	Moderate	Black oak---------	82	Yellow-poplar, white ash, shortleaf pine, eastern white pine, loblolly pine, northern red oak.
						White oak---------	74	
						Yellow-poplar-----	---	
						Hickory-----------	---	
						White ash---------	---	
Wellston------ (north slopes)	2r	Moderate	Moderate	Slight	Moderate	Northern red oak--	74	Eastern white pine, black walnut, yellow-poplar, white oak, northern red oak, white ash, shortleaf pine, loblolly pine.
						Yellow-poplar-----	90	
						Virginia pine-----	67	
						White oak---------	82	
						Black walnut------	---	
						Black cherry------	---	
						Sugar maple-------	---	
						White ash---------	---	
						Black oak---------	80	
						Hickory-----------	---	
						Shortleaf pine----	75	
						Chestnut oak------	78	
Rosine-------- (north slopes)	2r	Moderate	Moderate	Slight	Moderate	Yellow-poplar-----	90	Yellow-poplar, white ash, white oak, northern red oak, eastern white pine, shortleaf pine, loblolly pine.
						White oak---------	80	
						Pignut hickory----	---	
						Black oak---------	80	
						Black walnut------	---	
						White ash---------	---	
						Black cherry------	---	
						American beech----	---	
Frondorf------ (south slopes)	3r	Moderate	Moderate	Moderate	Moderate	Black oak---------	75	Shortleaf pine, white oak, loblolly pine.
						White oak---------	68	
						Post oak----------	73	
						Scarlet oak-------	---	
Wellston------ (south slopes)	3r	Moderate	Moderate	Moderate	Moderate	Black oak---------	---	Eastern white pine, white oak, shortleaf pine, loblolly pine.
						Virginia pine-----	70	
						White oak---------	74	
						Sugar maple-------	---	
						Shortleaf pine----	---	
						Chestnut oak------	---	
						Post oak----------	---	
Rosine-------- (south slopes)	3r	Moderate	Moderate	Moderate	Moderate	Black oak---------	70	White oak, shortleaf pine, loblolly pine.
						White oak---------	68	
						Scarlet oak-------	---	
						Pignut hickory----	---	

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Map symbol and soil name	Ordination symbol	Management concerns				Potential productivity		Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Plant competition	Common trees	Site index	
FwD3, FwE3:								
Frondorf (north slopes)	3r	Moderate	Moderate	Moderate	Moderate	Black oak White oak Yellow-poplar Hickory White ash	--- --- --- --- ---	Shortleaf pine, eastern white pine, loblolly pine, white oak, northern red oak.
Wellston (north slopes)	3r	Moderate	Moderate	Moderate	Moderate	Northern red oak Yellow-poplar Virginia pine White oak Black walnut Black cherry Sugar maple White ash Black oak Hickory Shortleaf pine Chestnut oak	--- --- --- --- --- --- --- --- --- --- --- ---	Eastern white pine, white oak, northern red oak, white ash, shortleaf pine, loblolly pine.
Rosine (north slopes)	3r	Moderate	Moderate	Moderate	Moderate	Yellow-poplar White oak Pignut hickory Black oak Black walnut White ash Black cherry American beech	80 --- --- --- --- --- --- ---	White ash, white oak, northern red oak, eastern white pine, shortleaf pine, loblolly pine.
Frondorf (south slopes)	4r	Moderate	Moderate	Moderate	Slight	Black oak White oak Post oak Scarlet oak	60 --- --- ---	Shortleaf pine, loblolly pine, Virginia pine.
Wellston (south slopes)	4r	Moderate	Moderate	Moderate	Slight	Black oak Virginia pine White oak Sugar maple Shortleaf pine Chestnut oak Post oak	60 --- --- --- --- --- ---	Shortleaf pine, loblolly pine, Virginia pine.
Rosine (south slopes)	4r	Moderate	Moderate	Moderate	Slight	Black oak White oak Scarlet oak Pignut hickory	--- --- --- ---	Shortleaf pine, loblolly pine, Virginia pine.
He Henshaw	1w	Slight	Moderate	Slight	Severe	Pin oak Yellow-poplar Sweetgum Hackberry	95 95 95 ---	Green ash, sweetgum, eastern cottonwood, yellow-poplar.
HoB2 Hosmer	2o	Slight	Slight	Slight	Moderate	White oak Yellow-poplar Virginia pine Sugar maple	75 90 75 75	Eastern white pine, shortleaf pine, yellow-poplar, white ash.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Map symbol and soil name	Ordination symbol	Management concerns				Potential productivity		Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Plant competition	Common trees	Site index	
Ka, Kc--------- Karnak	2w	Slight	Severe	Moderate	Severe	Pin oak---------- Swamp white oak--- Green ash--------- Sweetgum---------- Shumard oak------- Overcup oak------- River birch------- Sugar maple------- Red maple---------	96 --- 82 --- 100 --- --- --- ---	Pin oak, swamp white oak, green ash, baldcypress, sweetgum.
Ld---------- Lindside	1o	Slight	Slight	Slight	Severe	Northern red oak-- Yellow-poplar----- Black walnut------ White ash--------- White oak--------- Red maple---------	86 95 --- 85 85 ---	Eastern white pine, yellow-poplar, black walnut, northern red oak, shortleaf pine, white ash, white oak.
Mc---------- McGary	2w	Slight	Moderate	Slight	Moderate	Pin oak---------- Sweetgum---------- White oak--------- Green ash--------- Red maple--------- Post oak----------	85 90 75 --- --- ---	Eastern white pine, baldcypress, green ash, loblolly pine, American sycamore.
Me---------- Melvin	1w	Slight	Moderate	Moderate	Severe	Pin oak---------- Cottonwood-------- Sweetgum---------- Green ash---------	101 95 92 ---	Pin oak, American sycamore, sweetgum, loblolly pine, green ash, eastern cottonwood.
Ne---------- Newark	1w	Slight	Moderate	Slight	Severe	Pin oak---------- Eastern cottonwood Overcup oak------- Sweetgum---------- Green ash---------	96 89 --- 88 ---	Eastern cottonwood, sweetgum, loblolly pine, American sycamore, eastern white pine.
No---------- Nolin	1o	Slight	Slight	Slight	Severe	Sweetgum---------- Yellow-poplar----- Cherrybark oak---- Eastern cottonwood American sycamore- River birch-------	92 107 97 --- --- ---	Yellow-poplar, eastern white pine, eastern cottonwood, white ash, cherrybark oak, sweetgum, black walnut.
OtA, OtB2------ Otwell	3o	Slight	Slight	Slight	Moderate	White oak--------- Black oak--------- Sugar maple------- Hickory----------	72 --- --- ---	Eastern white pine, loblolly pine, white ash, white oak.
Po---------- Pope	2o	Slight	Slight	Slight	Moderate	Northern red oak-- Yellow-poplar----- White oak--------- Hickory---------- Blackgum----------	--- 97 80 --- ---	Eastern white pine, yellow-poplar, loblolly pine, black walnut, white oak, northern red oak.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Map symbol and soil name	Ordination symbol	Management concerns				Potential productivity		Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Plant competition	Common trees	Site index	
RcC2:								
Rosine--------	2o	Slight	Slight	Slight	Moderate	Yellow-poplar-----	90	Yellow-poplar, white ash, white oak, northern red oak, eastern white pine, shortleaf pine, loblolly pine.
						White oak---------	80	
						Black oak---------	80	
						Pignut hickory----	---	
						Black walnut------	---	
						White ash---------	---	
						Black cherry------	---	
						American beech----	---	
Caneyville----	4c	Slight	Moderate	Slight	Slight	Black oak---------	65	Eastern redcedar, Virginia pine, loblolly pine.
						White oak---------	52	
						Eastern redcedar--	36	
						Sugar maple-------	---	
						Hickory-----------	---	
						Scarlet oak-------	53	
RcD2:								
Rosine-------- (north slopes)	2r	Moderate	Moderate	Slight	Moderate	Yellow-poplar-----	90	Yellow-poplar, white ash, white oak, northern red oak, eastern white pine, shortleaf pine, loblolly pine.
						White oak---------	80	
						Black oak---------	80	
						Pignut hickory----	---	
						Black walnut------	---	
						White ash---------	---	
						Black cherry------	---	
						American beech----	---	
Caneyville---- (north slopes)	3c	Moderate	Moderate	Slight	Moderate	Yellow-poplar-----	90	Yellow-poplar, white oak, white ash, eastern white pine.
						Black oak---------	71	
						White oak---------	64	
						Sugar Maple-------	---	
						Hickory-----------	---	
Rosine-------- (south slopes)	3r	Moderate	Moderate	Moderate	Moderate	Black oak---------	70	White oak, shortleaf pine, loblolly pine.
						White oak---------	68	
						Scarlet oak-------	---	
						Pignut hickory----	---	
Caneyville---- (south slopes)	4c	Moderate	Moderate	Moderate	Slight	Scarlet oak-------	53	Eastern redcedar, Virginia pine, loblolly pine.
						Eastern redcedar--	36	
						White oak---------	52	
						Sugar maple-------	---	
						Hickory-----------	---	
RoC3:								
Rosine--------	3o	Slight	Slight	Slight	Moderate	Yellow-poplar-----	80	White ash, white oak, northern red oak, eastern white pine, shortleaf pine, loblolly pine.
						White oak---------	70	
						Black oak---------	70	
						Pignut hickory----	---	
						Black walnut------	---	
						White ash---------	---	
						Black cherry------	---	
						American beech----	---	
Caneyville----	5c	Slight	Moderate	Slight	Slight	Black oak---------	65	Eastern redcedar, Virginia pine, loblolly pine.
						Eastern redcedar--	36	
						White oak---------	52	
						Sugar maple-------	---	
						Hickory-----------	---	

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Map symbol and soil name	Ordination symbol	Management concerns				Potential productivity		Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Plant competition	Common trees	Site index	
RoD3:								
Rosine-------- (north slopes)	3r	Moderate	Moderate	Slight	Moderate	Yellow-poplar-----	80	White ash, white oak, northern red oak, eastern white pine, shortleaf pine, loblolly pine.
						White oak---------	70	
						Black oak---------	70	
						Pignut hickory----	---	
						Black walnut------	---	
						White ash---------	---	
						Black cherry------	---	
						American beech----	---	
Caneyville---- (north slopes)	4c	Moderate	Moderate	Slight	Slight	Black oak---------	70	Virginia pine, eastern white pine, loblolly pine, white ash.
						Eastern redcedar--	45	
						White oak---------	---	
						Sugar maple-------	---	
						Yellow-poplar-----	---	
						Hickory-----------	---	
Rosine-------- (south slopes)	4r	Moderate	Moderate	Moderate	Moderate	Black oak---------	60	White oak, shortleaf pine, loblolly pine, Virginia pine.
						White oak---------	60	
						Scarlet oak-------	---	
						Pignut hickory----	---	
Caneyville---- (south slopes)	5c	Moderate	Moderate	Moderate	Slight	Black oak---------	65	Eastern redcedar, Virginia pine, loblolly pine.
						Eastern redcedar--	36	
						White oak---------	63	
SaB2---------- Sadler	3o	Slight	Slight	Slight	Moderate	White oak---------	65	Eastern white pine, shortleaf pine, yellow-poplar, white oak, northern red oak, loblolly pine.
						Yellow-poplar-----	85	
						Black oak---------	70	
						American beech----	---	
						Black cherry------	---	
						Red maple---------	---	
Sf---------- Steff	1o	Slight	Slight	Slight	Severe	Black oak---------	88	Yellow-poplar, eastern white pine, loblolly pine, sweetgum, cherrybark oak.
						Yellow-poplar-----	107	
						Sweetgum----------	100	
						River birch-------	---	
Sn---------- Stendal	2w	Slight	Moderate	Slight	Moderate	Pin oak-----------	90	Eastern white pine, baldcypress, American sycamore, green ash.
						Sweetgum----------	85	
						Yellow-poplar-----	90	
						Virginia pine-----	90	
Wb---------- Weinbach	2w	Slight	Moderate	Slight	Moderate	White oak---------	75	Eastern white pine, baldcypress, green ash, yellow-poplar, American sycamore.
						Pin oak-----------	88	
						Yellow-poplar-----	85	
						Sweetgum----------	88	
WeC2, WeC3----- Wellston	2o	Slight	Slight	Slight	Moderate	White oak---------	80	Eastern white pine, black walnut, yellow-poplar, white oak, northern red oak, white ash, loblolly pine.
						Yellow-poplar-----	90	
						Virginia pine-----	70	
						Black oak---------	80	
						Black walnut------	---	
						Black cherry------	---	
						Sugar maple-------	---	
						White ash---------	---	
						Hickory-----------	---	
						Chestnut oak------	78	

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Map symbol and soil name	Ordination symbol	Management concerns				Potential productivity		Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Plant competition	Common trees	Site index	
WeD2:								
Wellston------ (north slopes)	2r	Moderate	Moderate	Slight	Moderate	White oak---------	80	Eastern white pine, black walnut, yellow-poplar, white oak, northern red oak, white ash, loblolly pine, shortleaf pine.
						Yellow-poplar-----	90	
						Virginia pine-----	70	
						Black oak---------	80	
						Black walnut------	---	
						Black cherry------	---	
						Sugar maple-------	---	
						White ash---------	---	
						Hickory-----------	---	
						Chestnut oak------	78	
Wellston------ (south slopes)	3r	Moderate	Moderate	Moderate	Moderate	Black oak---------	70	Eastern white pine, white oak, loblolly pine, shortleaf pine.
						Virginia pine-----	---	
						White oak---------	74	
						Black gum---------	---	
						Post oak----------	---	
						Scarlet oak-------	---	
						Hickory-----------	---	
WeD3:								
Wellston------ (north slopes)	3r	Moderate	Moderate	Slight	Moderate	Black oak---------	70	Eastern white pine, white oak, northern red oak, white ash, shortleaf pine, loblolly pine.
						Yellow-poplar-----	80	
						Virginia pine-----	66	
						White oak---------	70	
						Black walnut------	---	
						Black cherry------	---	
						Sugar maple-------	---	
						White ash---------	---	
						Hickory-----------	---	
						Chestnut oak------	70	
Wellston------ (north slopes)	4r	Moderate	Moderate	Moderate	Slight	Black oak---------	60	White oak, shortleaf pine, loblolly pine.
						Virginia pine-----	---	
						White oak---------	60	
						Black cherry------	---	
						Sugar maple-------	---	
						Black gum---------	---	
						Post oak----------	---	
						Scarlet oak-------	---	
						Chestnut oak------	---	
ZaB2, ZaC2----- Zanesville	3o	Slight	Slight	Slight	Moderate	Black oak---------	70	Eastern white pine, shortleaf pine, loblolly pine.
						Virginia pine-----	66	
						White oak---------	60	
						Hickory-----------	---	
ZaC3----------- Zanesville	4o	Slight	Slight	Slight	Slight	Northern red oak--	---	Virginia pine, shortleaf pine, loblolly pine.
						Virginia pine-----	---	
						White oak---------	---	

TABLE 9.--RECREATIONAL DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
BfF:					
Bethesda	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.	Severe: droughty, slope.
Fairpoint	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope, erodes easily.	Severe: small stones, droughty, slope.
Morristown	Severe: slope.	Severe: slope.	Severe: small stones.	Severe: slope.	Severe: droughty, slope.
Bo Bonnie	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
Bp Bonnie	Severe: ponding, flooding.	Severe: ponding.	Severe: ponding, flooding.	Severe: ponding.	Severe: ponding.
Ca Calloway	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
CcD2 Caneyville	Moderate: percs slowly, depth to rock, slope.	Moderate: slope, percs slowly.	Severe: slope.	Severe: erodes easily.	Moderate: thin layer, slope.
Ct Clifty	Severe: flooding.	Moderate: small stones.	Moderate: small stones, flooding.	Slight	Moderate: small stones.
Cu Cuba	Severe: flooding.	Slight	Moderate: flooding.	Slight	Moderate: flooding.
Du Dumps	Variable	Variable	Variable	Variable	Variable.
EkA Elk	Severe: flooding.	Slight	Slight	Slight	Slight.
EkB2 Elk	Severe: flooding.	Slight	Moderate: slope.	Slight	Slight.
FbB:					
Fairpoint	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope, small stones, percs slowly.	Slight	Moderate: droughty.
Bethesda	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope, small stones, percs slowly.	Slight	Moderate: droughty.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
FbB:					
Morristown	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope, small stones, percs slowly.	Slight	Moderate: droughty.
FbD:					
Fairpoint	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Severe: erodes easily.	Moderate: droughty, slope.
Bethesda	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Severe: erodes easily.	Moderate: droughty, slope.
Morristown	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Severe: erodes easily.	Moderate: droughty, slope.
FmB:					
Fairpoint	Moderate: small stones, percs slowly.	Severe: small stones.	Severe: small stones.	Slight	Severe: droughty.
Bethesda	Moderate: small stones, percs slowly.	Moderate: small stones, percs slowly.	Severe: small stones.	Slight	Severe: droughty.
Morristown	Moderate: small stones, percs slowly.	Moderate: small stones, percs slowly.	Severe: small stones.	Slight	Severe: droughty.
FmD:					
Fairpoint	Moderate: small stones, percs slowly.	Severe: small stones.	Severe: slope, small stones.	Severe: erodes easily.	Severe: droughty.
Bethesda	Moderate: small stones, percs slowly.	Moderate: slope, small stones, percs slowly.	Severe: slope, small stones.	Slight	Severe: droughty.
Morristown	Moderate: slope, small stones, percs slowly.	Moderate: slope, small stones, percs slowly.	Severe: small stones.	Slight	Severe: droughty.
FrF:					
Frondorf	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, erodes easily.	Severe: slope.
Wellston	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, erodes easily.	Severe: slope.
FsD2, FwD3:					
Frondorf	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.	Severe: slope.
Wellston	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.	Severe: slope.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
FsD2, FwD3: Rosine	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.	Severe: slope.
FsE, FwE3: Frondorf	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, erodes easily.	Severe: slope.
Wellston	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, erodes easily.	Severe: slope.
Rosine	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, erodes easily.	Severe: slope.
He Henshaw	Severe: flooding, wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
HoB2 Hosmer	Severe: percs slowly.	Severe: percs slowly.	Severe: percs slowly.	Slight	Slight.
Ka Karnak	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
Kc Karnak	Severe: flooding, wetness, too clayey.	Severe: wetness, too clayey.	Severe: too clayey, wetness.	Severe: wetness, too clayey.	Severe: wetness, too clayey.
Ld Lindside	Severe: flooding.	Moderate: wetness.	Moderate: wetness, flooding.	Moderate: wetness.	Moderate: flooding.
Mc McGary	Severe: flooding, wetness.	Moderate: percs slowly, wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
Me Melvin	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
Ne Newark	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
No Nolin	Severe: flooding.	Slight	Moderate: flooding.	Slight	Moderate: flooding.
OtA, OtB2 Otwell	Severe: flooding, percs slowly.	Severe: percs slowly.	Severe: percs slowly.	Slight	Slight.
Pi. Pits					
Po Pope	Severe: flooding.	Slight	Moderate: flooding.	Slight	Moderate: flooding.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
RcC2:					
Rosine	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
Caneyville	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Severe: erodes easily.	Moderate: slope, thin layer.
RcD2:					
Rosine	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.	Severe: slope.
Caneyville	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.	Severe: slope.
RoC3:					
Rosine	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
Caneyville	Severe: too clayey.	Severe: too clayey.	Severe: slope, too clayey.	Severe: too clayey.	Severe: too clayey.
RoD3:					
Rosine	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.	Severe: slope.
Caneyville	Severe: slope, too clayey.	Severe: slope, too clayey.	Severe: slope, too clayey.	Severe: too clayey.	Severe: slope, too clayey.
SaB2 Sadler	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Moderate: slope, wetness, percs slowly.	Moderate: wetness.	Moderate: wetness.
Sf Steff	Severe: flooding.	Moderate: wetness.	Moderate: flooding, wetness.	Moderate: wetness.	Moderate: wetness, flooding.
Sn Stendal	Severe: flooding, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, flooding.
Wb Weinbach	Severe: flooding, wetness, percs slowly.	Severe: percs slowly.	Severe: wetness, percs slowly.	Moderate: wetness.	Moderate: wetness.
WeC2, WeC3 Wellston	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
WeD2, WeD3 Wellston	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.	Severe: slope.
ZaB2 Zanesville	Moderate: percs slowly, wetness.	Moderate: wetness, percs slowly.	Moderate: slope, wetness, percs slowly.	Slight	Slight.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
ZaC2, ZaC3---------- Zanesville	Moderate: slope, percs slowly, wetness.	Moderate: slope, wetness, percs slowly.	Severe: slope.	Severe: erodes easily.	Moderate: slope.

TABLE 10.--WILDLIFE HABITAT

[See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates that the soil was not rated]

Map symbol and soil name	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
BfF:										
Bethesda	Very poor.	Very poor.	Poor	Poor	Poor	Very poor.	Very poor.	Very poor.	Poor	Very poor.
Fairpoint	Very poor.	Very poor.	Poor	Poor	Poor	Very poor.	Very poor.	Very poor.	Poor	Very poor.
Morristown	Very poor.	Very poor.	Poor	Poor	Poor	Very poor.	Very poor.	Very poor.	Poor	Very poor.
Bo Bonnie	Poor	Fair	Fair	Fair	Poor	Good	Good	Fair	Fair	Good.
Bp Bonnie	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Good	Good	Very poor.	Very poor.	Good.
Ca Calloway	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
CcD2 Caneyville	Very poor.	Poor	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
Ct Clifty	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
Cu Cuba	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
Du. Dumps										
EkA, EkB2 Elk	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
FbB:										
Fairpoint	Fair	Fair	Fair	Fair	Fair	Poor	Very poor.	Fair	Fair	Very poor.
Bethesda	Fair	Fair	Fair	Fair	Fair	Poor	Very poor.	Fair	Fair	Very poor.
Morristown	Fair	Fair	Fair	Fair	Fair	Poor	Very poor.	Fair	Fair	Very poor.
FbD:										
Fairpoint	Poor	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
Bethesda	Poor	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
Morristown	Poor	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.

TABLE 10.--WILDLIFE HABITAT--Continued

Map symbol and soil name	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
FmB:										
Fairpoint	Very poor.	Very poor.	Poor	Poor	Poor	Poor	Very poor.	Very poor.	Poor	Very poor.
Bethesda	Very poor.	Very poor.	Poor	Poor	Poor	Poor	Very poor.	Very poor.	Poor	Very poor.
Morristown	Very poor.	Very poor.	Poor	Poor	Poor	Poor	Very poor.	Very poor.	Poor	Very poor.
FmD:										
Fairpoint	Very poor.	Very poor.	Poor	Poor	Poor	Very poor.	Very poor.	Very poor.	Poor	Very poor.
Bethesda	Very poor.	Very poor.	Poor	Poor	Poor	Very poor.	Very poor.	Very poor.	Poor	Very poor.
Morristown	Very poor.	Very poor.	Poor	Poor	Poor	Very poor.	Very poor.	Very poor.	Poor	Very poor.
FrF:										
Frondorf	Very poor.	Poor	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
Wellston	Very poor.	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
FsD2, FwD3:										
Frondorf	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Wellston	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Rosine	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Fair	Very poor.
FsE, FwE3:										
Frondorf	Very poor.	Fair	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
Wellston	Very poor.	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Rosine	Very poor.	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Fair	Very poor.
He Henshaw	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
HoB2 Hosmer	Fair	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
Ka, Kc Karnak	Very poor.	Poor	Poor	Fair	Very poor.	Good	Good	Poor	Fair	Good.
Ld Lindside	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.

TABLE 10.--WILDLIFE HABITAT--Continued

Map symbol and soil name	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
Mc---------- McGary	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
Me---------- Melvin	Poor	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
Ne---------- Newark	Poor	Fair	Fair	Good	Good	Fair	Fair	Fair	Good	Fair.
No---------- Nolin	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
OtA, OtB2---------- Otwell	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
Pi. Pits										
Po---------- Pope	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
RcC2: Rosine----------	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Fair	Fair	Very poor.
Caneyville--------	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
RcD2: Rosine----------	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Fair	Very poor.
Caneyville--------	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
RoC3: Rosine----------	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Fair	Fair	Very poor.
Caneyville--------	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
RoD3: Rosine----------	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Fair	Very poor.
Caneyville--------	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
SaB2---------- Sadler	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
Sf---------- Steff	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
Sn---------- Stendal	Fair	Good	Fair	Good	Good	Good	Fair	Fair	Good	Fair.

TABLE 10.--WILDLIFE HABITAT--Continued

Map symbol and soil name	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
Wb---------- Weinbach	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
WeC2, WeC3--------- Wellston	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
WeD2, WeD3--------- Wellston	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
ZaB2---------- Zanesville	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
ZaC2, ZaC3--------- Zanesville	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.

TABLE 11.--BUILDING SITE DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation]

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
BfF:						
Bethesda	Severe: slope, slippage.	Severe: slope, slippage.	Severe: slope, slippage.	Severe: slope, slippage.	Severe: slope, slippage.	Severe: droughty, slope.
Fairpoint	Severe: slope, slippage.	Severe: slope, slippage.	Severe: slope, slippage.	Severe: slope, slippage.	Severe: slope, slippage.	Severe: small stones, droughty, slope.
Morristown	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: droughty, slope.
Bo Bonnie	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: wetness.
Bp Bonnie	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: flooding.	Severe: ponding.
Ca Calloway	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Moderate: low strength, wetness.	Moderate: wetness.
CcD2 Caneyville	Severe: depth to rock.	Moderate: depth to rock, shrink-swell.	Severe: depth to rock.	Severe: slope.	Severe: low strength, slope.	Moderate: slope, thin layer.
Ct Clifty	Moderate: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: small stones, flooding.
Cu Cuba	Moderate: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding, frost action.	Moderate: flooding.
Du. Dumps						
EkA, EkB2 Elk	Slight	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: low strength, flooding.	Slight.
FbB:						
Fairpoint	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: droughty.
Bethesda	Slight	Slight	Slight	Slight	Slight	Moderate: droughty.
Morristown	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: droughty.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
FbD:						
Fairpoint	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Moderate: slope, shrink-swell.	Moderate: droughty, slope.
Bethesda	Moderate: dense layer, slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope.
Morristown	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Moderate: slope, shrink-swell.	Moderate: droughty, slope.
FmB:						
Fairpoint	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: small stones, droughty, large stones.
Bethesda	Slight	Slight	Slight	Slight	Slight	Moderate: droughty, small stones, large stones.
Morristown	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: droughty, small stones, large stones.
FmD:						
Fairpoint	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Moderate: slope, shrink-swell.	Moderate: small stones, droughty, slope, large stones.
Bethesda	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope, small stones, large stones.
Morristown	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Moderate: slope, shrink-swell.	Moderate: droughty, slope, small stones, large stones.
FrF:						
Frondorf	Severe: slope.	Severe: slope.	Severe: slope, depth to rock.	Severe: slope.	Severe: slope.	Severe: slope.
Wellston	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, low strength.	Severe: slope.
FsD2, FwD3, FsE, FwE3:						
Frondorf	Severe: slope.	Severe: slope.	Severe: slope, depth to rock.	Severe: slope.	Severe: slope.	Severe: slope.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
FsD2, FwD3, FsE, FwE3: Wellston	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, low strength.	Severe: slope.
Rosine	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
He Henshaw	Severe: wetness.	Severe: wetness, flooding.	Severe: wetness, flooding.	Severe: wetness, flooding.	Severe: low strength.	Moderate: wetness.
HoB2 Hosmer	Moderate: wetness.	Slight	Moderate: wetness.	Slight	Moderate: low strength.	Slight.
Ka Karnak	Severe: wetness.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: wetness, flooding, shrink-swell.	Severe: wetness.
Kc Karnak	Severe: wetness.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: wetness, flooding, shrink-swell.	Severe: wetness, too clayey.
Ld Lindside	Severe: wetness.	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding.	Severe: flooding, low strength.	Moderate: flooding.
Mc McGary	Severe: wetness.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, shrink-swell.	Severe: low strength, shrink-swell.	Moderate: wetness.
Me Melvin	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: low strength, wetness, flooding.	Severe: wetness.
Ne Newark	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: low strength, wetness, flooding.	Severe: wetness.
No Nolin	Moderate: wetness, flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength, flooding.	Moderate: flooding.
OtA, OtB2 Otwell	Moderate: too clayey, wetness.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength.	Slight.
Pi. Pits						
Po Pope	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
RcC2:						
Rosine	Moderate: too clayey, slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength.	Moderate: slope.
Caneyville	Severe: depth to rock.	Moderate: shrink-swell, slope, depth to rock.	Severe: depth to rock.	Severe: slope.	Severe: low strength.	Moderate: slope, thin layer.
RcD2:						
Rosine	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
Caneyville	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
RoC3:						
Rosine	Moderate: too clayey, slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength.	Moderate: slope.
Caneyville	Severe: depth to rock.	Moderate: shrink-swell, slope, depth to rock.	Severe: depth to rock.	Severe: slope.	Severe: low strength.	Severe: too clayey.
RoD3:						
Rosine	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
Caneyville	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope, too clayey.
SaB2---------- Sadler	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness, slope.	Severe: low strength.	Moderate: wetness.
Sf---------- Steff	Severe: wetness.	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding.	Severe: flooding.	Moderate: flooding.
Sn---------- Stendal	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding.	Moderate: wetness, flooding.
Wb---------- Weinbach	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: low strength.	Moderate: wetness.
WeC2, WeC3-------- Wellston	Moderate: depth to rock, slope.	Moderate: slope.	Moderate: depth to rock, slope.	Severe: slope.	Severe: low strength.	Moderate: slope.
WeD2, WeD3-------- Wellston	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, low strength.	Severe: slope.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
ZaB2---------- Zanesville	Moderate: depth to rock, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: slope, wetness.	Severe: low strength.	Slight.
ZaC2, ZaC3-------- Zanesville	Moderate: slope, wetness, depth to rock.	Moderate: slope, wetness.	Severe: wetness.	Severe: slope.	Severe: low strength.	Moderate: slope.

TABLE 12.--SANITARY FACILITIES

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," "good," "fair," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation]

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
BfF:					
Bethesda	Severe: percs slowly, slope, slippage.	Severe: slope.	Severe: slope, slippage.	Severe: slope.	Poor: small stones, slope.
Fairpoint	Severe: percs slowly, slope, slippage.	Severe: slope.	Severe: slope, slippage.	Severe: slope.	Poor: small stones, slope.
Morristown	Severe: percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: small stones, slope.
Bo Bonnie	Severe: flooding, wetness, percs slowly.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, ponding.	Poor: wetness.
Bp Bonnie	Severe: flooding, ponding, percs slowly.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
Ca Calloway	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
CcD2 Caneyville	Severe: depth to rock, percs slowly.	Severe: depth to rock, slope.	Severe: depth to rock, too clayey, slope.	Severe: depth to rock.	Poor: area reclaim, too clayey, thin layer.
Ct Clifty	Severe: flooding, poor filter.	Severe: seepage, flooding.	Severe: flooding, seepage.	Severe: flooding, seepage.	Fair: small stones.
Cu Cuba	Severe: flooding.	Severe: flooding.	Severe: flooding, too sandy.	Severe: flooding.	Good.
Du Dumps	Variable	Variable	Variable	Variable	Variable.
EkA, EkB2 Elk	Moderate: flooding, percs slowly.	Severe: flooding.	Moderate: flooding, too clayey.	Moderate: flooding.	Fair: too clayey.
FbB:					
Fairpoint	Severe: percs slowly.	Moderate: slope.	Moderate: too clayey.	Slight	Poor: small stones.
Bethesda	Severe: percs slowly.	Moderate: slope.	Moderate: too clayey.	Slight	Poor: small stones.

TABLE 12.--SANITARY FACILITIES--Continued

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
FbB:					
Morristown	Severe: percs slowly.	Moderate: slope.	Moderate: too clayey.	Slight	Poor: small stones.
FbD:					
Fairpoint	Severe: percs slowly.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Poor: small stones.
Bethesda	Severe: percs slowly.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Poor: small stones.
Morristown	Severe: percs slowly.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Poor: small stones.
FmB:					
Fairpoint	Severe: percs slowly.	Moderate: slope, large stones.	Moderate: too clayey, large stones.	Slight	Poor: small stones.
Bethesda	Severe: percs slowly.	Moderate: slope.	Moderate: too clayey.	Slight	Poor: small stones.
Morristown	Severe: percs slowly.	Moderate: slope.	Moderate: too clayey.	Slight	Poor: small stones.
FmD:					
Fairpoint	Severe: percs slowly.	Severe: slope.	Moderate: slope, too clayey, large stones.	Moderate: slope.	Poor: small stones.
Bethesda	Severe: percs slowly.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Poor: small stones.
Morristown	Severe: percs slowly.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Poor: small stones.
FrF:					
Frondorf	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: area reclaim, small stones, slope.
Wellston	Severe: slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Poor: slope.
FsD2, FsE, FwD3, FwE3:					
Frondorf	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: area reclaim, small stones, slope.
Wellston	Severe: slope.	Severe: slope.	Severe: depth to rock,	Severe: slope.	Poor: slope.

TABLE 12.--SANITARY FACILITIES--Continued

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
FsD2, FsE, FwD3, FwE3: Rosine	Severe: percs slowly, slope.	Severe: slope.	Severe: depth to rock, slope, too clayey.	Severe: slope.	Poor: too clayey, hard to pack, slope.
He Henshaw	Severe: wetness, percs slowly.	Severe: wetness, flooding.	Severe: wetness.	Severe: wetness.	Poor: wetness.
HoB2 Hosmer	Severe: wetness, percs slowly.	Moderate: slope, wetness.	Moderate: wetness, too clayey.	Slight	Fair: wetness.
Ka, Kc Karnak	Severe: flooding, wetness, percs slowly.	Severe: flooding, wetness.	Severe: flooding, wetness, too clayey.	Severe: flooding, wetness.	Poor: too clayey, hard to pack, wetness.
Ld Lindside	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Fair: too clayey, wetness.
Mc McGary	Severe: wetness, percs slowly.	Severe: wetness, flooding.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
Me Melvin	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: wetness.
Ne Newark	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: wetness.
No Nolin	Severe: flooding.	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding.	Fair: too clayey.
OtA Otwell	Severe: wetness, percs slowly.	Slight	Moderate: flooding, wetness, too clayey.	Moderate: flooding, wetness.	Fair: too clayey, wetness.
OtB2 Otwell	Severe: wetness, percs slowly.	Moderate: slope.	Moderate: flooding, wetness, too clayey.	Moderate: flooding, wetness.	Fair: too clayey, wetness.
Pi. Pits					
Po Pope	Severe: flooding.	Severe: seepage, flooding.	Severe: flooding, seepage.	Severe: flooding, seepage.	Fair: too sandy, small stones.
RcC2: Rosine	Severe: percs slowly.	Severe: slope.	Severe: depth to rock, too clayey.	Moderate: depth to rock, slope.	Poor: too clayey, hard to pack.

TABLE 12.--SANITARY FACILITIES--Continued

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
RcC2:					
Caneyville	Severe: depth to rock, percs slowly.	Severe: depth to rock, slope.	Severe: depth to rock, too clayey.	Severe: depth to rock.	Poor: area reclaim, too clayey, hard to pack.
RcD2:					
Rosine	Severe: percs slowly, slope.	Severe: slope.	Severe: depth to rock, slope, too clayey.	Severe: slope.	Poor: too clayey, hard to pack, slope.
Caneyville	Severe: depth to rock, percs slowly, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope, too clayey.	Severe: depth to rock, slope.	Poor: area reclaim, too clayey, hard to pack.
RoC3:					
Rosine	Severe: percs slowly.	Severe: slope.	Severe: depth to rock, too clayey.	Moderate: depth to rock, slope.	Poor: too clayey, hard to pack.
Caneyville	Severe: depth to rock, percs slowly.	Severe: depth to rock, slope.	Severe: depth to rock, too clayey.	Severe: depth to rock.	Poor: area reclaim, too clayey, hard to pack.
RoD3:					
Rosine	Severe: percs slowly, slope.	Severe: slope.	Severe: depth to rock, slope, too clayey.	Severe: slope.	Poor: too clayey, hard to pack, slope.
Caneyville	Severe: depth to rock, percs slowly, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope, too clayey.	Severe: depth to rock, slope.	Poor: area reclaim, too clayey, hard to pack.
SaB2 Sadler	Severe: wetness, percs slowly.	Severe: wetness.	Severe: depth to rock, wetness.	Moderate: depth to rock, wetness.	Fair: area reclaim, too clayey, wetness.
Sf Steff	Severe: flooding, wetness.	Severe: flooding, wetness, seepage.	Severe: flooding, wetness, seepage.	Severe: flooding, wetness, seepage.	Fair: too clayey, wetness.
Sn Stendal	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: wetness.
Wb Weinbach	Severe: wetness, percs slowly.	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
WeC2, WeC3 Wellston	Moderate: depth to rock, percs slowly, slope.	Severe: slope.	Severe: depth to rock.	Moderate: depth to rock, slope.	Fair: slope.
WeD2, WeD3 Wellston	Severe: slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Poor: slope.

TABLE 12.--SANITARY FACILITIES--Continued

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
ZaB2---------- Zanesville	Severe: percs slowly, wetness.	Severe: wetness.	Severe: depth to rock.	Moderate: depth to rock, wetness.	Fair: too clayey, area reclaim, small stones.
ZaC2, ZaC3---------- Zanesville	Severe: percs slowly, wetness.	Severe: slope, wetness.	Severe: depth to rock.	Moderate: depth to rock, slope, wetness.	Fair: slope, too clayey, area reclaim.

TABLE 13.--CONSTRUCTION MATERIALS

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," "poor," "probable," and "improbable." Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation]

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
BfF:				
Bethesda	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones, slope.
Fairpoint	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
Morristown	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones, slope.
Bo, Bp Bonnie	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
Ca Calloway	Fair: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Good.
CcD2 Caneyville	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
Ct Clifty	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim.
Cu Cuba	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Du Dumps	Variable	Variable	Variable	Variable.
EkA, EkB2 Elk	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
FbB, FbD:				
Fairpoint	Fair: shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, large stones.
Bethesda	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones.
Morristown	Fair: shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones.
FmB, FmD:				
Fairpoint	Fair: shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
FmB, FmD:				
Bethesda	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
Morristown	Fair: shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones.
FrF:				
Frondorf	Poor: area reclaim, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
Wellston	Poor: slope, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
FsD2, FwD3:				
Frondorf	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
Wellston	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
Rosine	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
FsE, FwE3:				
Frondorf	Poor: area reclaim, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
Wellston	Poor: slope, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
Rosine	Poor: low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
He Henshaw	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
HoB2 Hosmer	Fair: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
Ka Karnak	Poor: low strength, wetness, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
Kc Karnak	Poor: low strength, wetness, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
Ld Lindside	Fair: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Good.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
Mc McGary	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
Me Melvin	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
Ne Newark	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
No Nolin	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
OtA, OtB2 Otwell	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
Pi. Pits				
Po Pope	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim.
RcC2: Rosine	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: slope.
Caneyville	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
RcD2: Rosine	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
Caneyville	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, slope.
RoC3: Rosine	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: slope.
Caneyville	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
RoD3: Rosine	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
Caneyville	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, slope.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
SaB2---------- Sadler	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, area reclaim, too clayey.
Sf---------- Steff	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Good.
Sn---------- Stendal	Fair: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Good.
Wb---------- Weinbach	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
WeC2, WeC3---------- Wellston	Poor: thin layer, low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, area reclaim.
WeD2, WeD3---------- Wellston	Fair: thin layer, slope.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, slope, area reclaim.
ZaB2, ZaC2, ZaC3------ Zanesville	Severe: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim.

TABLE 14.--WATER MANAGEMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not evaluated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation.]

Map symbol and soil name	Limitations for--		Features affecting--		
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Terraces and diversions	Grassed waterways
BfF:					
Bethesda	Severe: slope, slippage.	Moderate: piping.	Deep to water	Slope, large stones, slippage.	Large stones, slope, droughty.
Fairpoint	Severe: slope, slippage.	Severe: piping.	Deep to water	Slope, large stones, erodes easily.	Large stones, slope, erodes easily.
Morristown	Severe: slope.	Severe: piping.	Deep to water	Slope. large stones.	Large stones, slope, droughty.
Bo Bonnie	Slight	Severe: wetness.	Flooding	Erodes easily	Wetness, erodes easily.
Bp Bonnie	Slight	Severe: ponding.	Ponding	Ponding	Ponding.
Ca Calloway	Slight	Severe: piping.	Percs slowly	Erodes easily, wetness, rooting depth.	Wetness, erodes easily, rooting depth.
CcD2 Caneyville	Severe: depth to rock.	Severe: thin layer.	Deep to water	Slope, depth to rock, erodes easily.	Slope, erodes easily, depth to rock.
Ct Clifty	Severe: seepage.	Severe: piping.	Deep to water	Favorable	Favorable.
Cu Cuba	Moderate: seepage.	Severe: piping.	Deep to water	Erodes easily	Erodes easily.
Du Dumps	Variable	Variable	Variable	Variable	Variable.
EkA, EkB2 Elk	Moderate: seepage.	Severe: piping.	Deep to water	Erodes easily	Erodes easily.
FbB:					
Fairpoint	Slight	Severe: piping.	Deep to water	Large stones, erodes easily.	Large stones, erodes easily, droughty.
Bethesda	Slight	Moderate: seepage, piping.	Deep to water	Large stones, erodes easily.	Large stones, erodes easily, droughty.
Morristown	Slight	Severe: piping.	Deep to water	Erodes easily	Erodes easily.
FbD:					
Fairpoint	Slight	Severe: piping.	Deep to water	Slope, large stones, erodes easily.	Large stones, slope, erodes easily.

TABLE 14.--WATER MANAGEMENT--Continued

Map symbol and soil name	Limitations for--		Features affecting--		
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Terraces and diversions	Grassed waterways
FbD:					
Bethesda	Slight	Moderate: seepage, piping.	Deep to water	Slope, large stones, erodes easily.	Large stones, slope, erodes easily.
Morristown	Slight	Severe: piping.	Deep to water	Slope, erodes easily.	Large stones, slope, erodes easily.
FmB:					
Fairpoint	Slight	Severe: piping.	Deep to water	Large stones, erodes easily.	Large stones, erodes easily, droughty.
Bethesda	Slight	Moderate: seepage, piping.	Deep to water	Large stones	Large stones, droughty.
Morristown	Slight	Severe: piping.	Deep to water	Large stones	Large stones, droughty.
FmD:					
Fairpoint	Slight	Severe: piping.	Deep to water	Slope, large stones, erodes easily.	Large stones, slope, erodes easily.
Bethesda	Slight	Moderate: seepage, piping.	Deep to water	Slope, large stones.	Large stones, slope, droughty.
Morristown	Slight	Severe: piping.	Deep to water	Slope, large stones.	Large stones, slope, droughty.
FrF:					
Frondorf	Severe: slope.	Severe: piping, thin layer.	Deep to water	Slope, erodes easily, depth to rock.	Slope, depth to rock, erodes easily.
Wellston	Severe: slope.	Severe: piping.	Deep to water	Slope, erodes easily.	Slope, erodes easily.
FsD2, FwD3:					
Frondorf	Moderate: seepage, depth to rock.	Severe: piping, thin layer.	Deep to water	Slope, erodes easily, depth to rock.	Slope, depth to rock, erodes easily.
Wellston	Moderate: seepage, depth to rock.	Severe: piping.	Deep to water	Slope, erodes easily.	Slope, erodes easily.
Rosine	Moderate: seepage, depth to rock.	Moderate: hard to pack, thin layer.	Deep to water	Slope, erodes easily.	Slope, erodes easily.
FsE, FwD3:					
Frondorf	Severe: slope.	Severe: thin layer, piping.	Depth to rock, slope.	Slope, erodes easily, depth to rock.	Slope, erodes easily, depth to rock.

TABLE 14.--WATER MANAGEMENT--Continued

Map symbol and soil name	Limitations for--		Features affecting--		
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Terraces and diversions	Grassed waterways
FsE, FwD3: Wellston	Severe: slope.	Severe: piping.	Slope	Slope, erodes easily.	Slope, erodes easily.
Rosine	Severe: slope.	Moderate: hard to pack, thin layer.	Slope	Slope, erodes easily.	Slope, erodes easily.
He Henshaw	Slight	Severe: wetness.	Favorable	Erodes easily, wetness.	Wetness, erodes easily.
HoB2 Hosmer	Moderate: seepage.	Severe: piping.	Percs slowly, slope.	Erodes easily, wetness, percs slowly.	Erodes easily, rooting depth, percs slowly.
Ka Karnak	Slight	Severe: hard to pack, wetness.	Percs slowly, flooding.	Wetness, percs slowly.	Wetness, percs slowly.
Kc Karnak	Slight	Severe: hard to pack, wetness.	Percs slowly, flooding.	Wetness, percs slowly.	Wetness, percs slowly.
Ld Lindside	Moderate: seepage.	Severe: piping, wetness.	Flooding	Wetness, erodes easily.	Erodes easily.
Mc McGary	Slight	Severe: wetness.	Percs slowly	Erodes easily, wetness, percs slowly.	Wetness, erodes easily.
Me Melvin	Moderate: seepage.	Severe: piping, wetness.	Flooding	Erodes easily, wetness.	Wetness, erodes easily.
Ne Newark	Moderate: seepage.	Severe: piping, wetness.	Flooding	Erodes easily, wetness.	Wetness, erodes easily.
No Nolin	Moderate: seepage.	Severe: piping.	Deep to water	Erodes easily	Erodes easily.
OtA Otwell	Slight	Slight	Percs slowly	Erodes easily, rooting depth, percs slowly.	Erodes easily, rooting depth, percs slowly.
OtB2 Otwell	Slight	Slight	Percs slowly	Erodes easily, rooting depth, percs slowly.	Erodes easily, rooting depth, percs slowly.
Pi. Pits					
Po Pope	Severe: seepage.	Severe: piping.	Deep to water	Favorable	Favorable.
RcC2, RcD2: Rosine	Moderate: seepage, depth to rock.	Moderate: hard to pack, thin layer.	Deep to water	Slope, erodes easily.	Slope, erodes easily.

TABLE 14.--WATER MANAGEMENT--Continued

Map symbol and soil name	Limitations for--		Features affecting--		
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Terraces and diversions	Grassed waterways
RcC2, RcD2: Caneyville	Moderate: depth to rock.	Severe: thin layer, hard to pack.	Deep to water	Slope, depth to rock, erodes easily.	Slope, depth to rock.
RoC3, RoD3: Rosine	Moderate: seepage, depth to rock.	Moderate: thin layer, hard to pack.	Deep to water	Slope, erodes easily.	Slope, erodes easily.
Caneyville	Moderate: depth to rock, slope.	Severe: hard to pack, thin layer.	Deep to water	Slope, depth to rock.	Slope, depth to rock.
SaB2 Sadler	Moderate: seepage, depth to rock.	Severe: piping.	Percs slowly, slope.	Erodes easily, wetness, percs slowly.	Erodes easily, rooting depth, percs slowly.
Sf Steff	Severe: seepage.	Severe: piping, wetness.	Flooding	Erodes easily, wetness.	Erodes easily.
Sn Stendal	Moderate: seepage.	Severe: piping, wetness.	Flooding	Erodes easily, wetness.	Wetness, erodes easily.
Wb Weinbach	Moderate: seepage.	Moderate: thin layer, piping, wetness.	Percs slowly	Erodes easily, wetness, rooting depth.	Wetness, erodes easily, rooting depth.
WeC2, WeC3, WeD2, WeD3 Wellston	Moderate: seepage, depth to rock.	Severe: piping.	Deep to water	Slope, erodes easily.	Slope, erodes easily.
ZaB2 Zanesville	Moderate: depth to rock, seepage.	Severe: piping.	Percs slowly, slope.	Erodes easily, wetness, rooting depth.	Erodes easily, rooting depth.
ZaC2, ZaC3 Zanesville	Moderate: depth to rock, seepage.	Severe: piping.	Percs slowly, slope.	Slope, erodes easily, wetness.	Slope, erodes easily, rooting depth.

TABLE 15.--ENGINEERING INDEX PROPERTIES

[The symbol < means less than; > means more than. Absence of an entry indicates that data were not estimated. Some soils may have Unified classifications and USDA textures in addition to those shown. In general, the dominant classifications and textures are shown]

Map symbol and soil name	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
BfF:											
Bethesda--------	0-6	Very channery loam.	ML, GM, GM-GC, CL-ML	A-4, A-6	0-15	65-90	55-80	50-80	35-75	25-40	4-14
	6-60	Very shaly clay loam, very gravelly silty clay loam, silt loam.	GM, GC, ML CL	A-4, A-6, A-7, A-2	10-30	40-80	25-75	20-65	18-60	24-50	3-23
Fairpoint-------	0-4	Channery silt loam	CL, CL-ML, SC, GC	A-4, A-6, A-2	5-15	55-90	45-85	40-85	30-75	20-40	4-18
	4-60	Gravelly clay loam, very shaly silty clay loam.	GC, CL, CL-ML, SC	A-4, A-6, A-7, A-2	15-30	55-75	25-65	20-65	15-60	25-50	4-24
Morristown------	0-7	Shaly silt loam	CL, GC, SC SM-SC	A-4, A-6	5-15	70-95	50-80	45-75	35-70	20-40	4-18
	7-70	Very gravelly silty clay loam, cobbly sandy clay loam, channery clay loam, silt loam.	GC, CL, CL-ML, GM-GC	A-7, A-6, A-4, A-2	10-25	40-85	40-80	25-70	20-60	25-50	4-24
Bo, Bp----------	0-6	Silt loam--------	CL	A-4, A-6	0	100	100	95-100	90-100	27-34	8-12
Bonnie	6-60	Silt loam--------	CL	A-4, A-6	0	100	100	95-100	90-100	27-34	8-12
Ca---------------	0-24	Silt loam--------	CL-ML, CL	A-4, A-6	0	100	100	100	90-100	25-35	5-15
Calloway	24-40	Silt loam, silty clay loam.	CL	A-6	0	100	100	100	90-95	30-40	12-20
	40-65	Silt loam, silty clay loam.	CL-ML, CL	A-4, A-6	0	100	100	100	90-100	25-35	5-15
CcD2------------	0-5	Silt loam--------	ML, CL, CL-ML	A-4, A-6	0-3	90-100	85-100	75-100	60-95	20-35	2-12
Caneyville	5-30	Clay, silty clay	CH	A-7	0-3	90-100	85-100	75-100	65-100	50-75	30-45
	30	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Ct---------------	0-9	Gravelly silt loam.	ML, CL-ML, GM, GM-GC	A-4	0-10	65-85	60-80	55-75	45-70	20-35	2-10
Clifty	9-38	Gravelly silt loam, gravelly loam.	ML, CL-ML, GM, GM-GC	A-4	0-15	55-75	50-70	45-65	35-60	20-35	2-10
	38-60	Gravelly silt loam, very gravelly loam, gravelly sandy loam.	GM, GM-GC, SM	A-2, A-4, A-1	0-25	40-75	35-70	25-60	15-50	<30	NP-7
Cu---------------	0-60	Silt loam--------	CL, ML, CL-ML	A-4, A-6	0	100	95-100	90-100	70-90	25-35	3-12
Cuba											

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Du. Dumps											
EkA, EkB2-------- Elk	0-9	Silt loam--------	ML, CL, CL-ML	A-4	0	95-100	95-100	85-100	70-95	25-35	3-10
	9-50	Silty clay loam, silt loam.	ML, CL, CL-ML	A-4, A-6	0	95-100	90-100	85-100	75-100	25-40	5-15
	50-60	Silty clay loam, silt loam.	ML, CL, CL-ML, SM-SC	A-4, A-6	0	75-100	50-100	45-100	40-95	25-40	5-15
FbB, FbD: Fairpoint-------	0-8	Silt loam--------	CL, CL-ML	A-4, A-6	0-5	90-100	80-100	70-100	50-90	20-40	4-18
	8-68	Gravelly clay loam, very shaly silty clay loam.	GC, CL, CL-ML, SC	A-4, A-6, A-7, A-2	15-30	55-75	25-65	20-65	15-60	25-50	4-24
Bethesda--------	0-8	Silt loam--------	ML, CL, CL-ML	A-4, A-6	0-5	85-100	80-100	70-100	51-90	25-40	4-14
	8-68	Very shaly clay loam, very gravelly silty clay loam, silt loam.	GM, GC, ML CL	A-4, A-6, A-7, A-2	10-30	40-80	25-65	20-65	18-60	24-50	3-23
Morristown------	0-8	Silt loam--------	CL, CL-ML	A-4, A-6	0-5	90-100	80-100	70-100	51-90	20-40	4-18
	8-78	Very gravelly silty clay loam, cobbly sandy clay loam, channery clay loam, silt loam.	GM-GC, GC, CL, CL-ML	A-7, A-6, A-4, A-2	10-25	40-85	40-80	25-70	20-60	25-50	4-24
FmB, FmD: Fairpoint-------	0-4	Channery silt loam	CL, CL-ML, SC, GC	A-4, A-6, A-2	5-15	55-90	45-85	40-85	30-75	20-40	4-18
	4-60	Gravelly clay loam, very shaly silty clay loam.	GC, CL, CL-ML, SC	A-4, A-6, A-7, A-2	15-30	55-75	25-65	20-65	15-60	25-50	4-24
Bethesda--------	0-6	Very channery loam.	ML, GM, GM-GC, CL-ML	A-4, A-6	0-15	65-90	55-80	50-80	35-75	25-40	4-14
	6-60	Very shaly clay loam, very gravelly silty clay loam.	GM, GC, ML CL	A-4, A-6, A-7, A-2	10-30	40-80	25-65	20-65	18-60	24-50	3-23
Morristown------	0-7	Shaly silt loam--	CL, GC, SC SM-SC	A-4, A-6	5-15	70-95	50-80	45-75	35-70	20-40	4-18
	7-70	Very gravelly silty clay loam, cobbly sandy clay loam, channery clay loam, silt loam.	GC, CL, CL-ML, GM-GC	A-7, A-6, A-4, A-2	10-25	40-85	40-80	25-70	20-60	25-50	4-24

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
FrF:											
Frondorf--------	0-20	Silt loam--------	ML, CL, CL-ML	A-4	0-5	90-100	90-100	85-100	75-100	25-35	5-10
	20-36	Channery silty clay loam, gravelly silt loam, gravelly loam.	ML, CL, GM GC	A-4, A-6, A-2, A-7	10-40	55-90	50-85	40-80	30-75	<45	NP-25
	36	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Wellston--------	0-6	Silt loam--------	ML	A-4	0	95-100	90-100	85-100	70-95	25-35	3-10
	6-36	Silt loam, silty clay loam.	CL, CL-ML	A-6, A-4	0-5	75-100	70-100	60-95	60-90	25-40	5-20
	36-65	Silt loam, loam, channery loam.	CL-ML, CL, SC, SM-SC	A-4, A-6	0-10	65-90	65-90	60-90	40-65	20-35	5-15
	65	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
FsD2, FsE:											
Frondorf--------	0-20	Silt loam--------	ML, CL, CL-ML	A-4	0-5	90-100	90-100	85-100	75-100	25-35	5-10
	20-36	Channery silty clay loam, gravelly silt loam, gravelly loam.	ML, CL, GM GC	A-4, A-6, A-2, A-7	10-40	55-90	50-85	40-80	30-75	<45	NP-25
	36	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Wellston--------	0-6	Silt loam--------	ML	A-4	0	95-100	90-100	85-100	70-95	25-35	3-10
	6-36	Silt loam, silty clay loam.	CL, CL-ML	A-6, A-4	0-5	75-100	70-100	60-95	60-90	25-40	5-20
	36-65	Silt loam, loam, channery loam.	CL-ML, CL, SC, SM-SC	A-4, A-6	0-10	65-90	65-90	60-90	40-65	20-35	5-15
	65	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Rosine----------	0-4	Silt loam--------	ML, CL, CL-ML	A-4	0-5	95-100	90-100	85-100	70-95	20-30	3-10
	4-22	Silty clay loam, silt loam.	CL, CL-ML	A-6, A-4	0-5	75-100	70-100	60-95	60-90	25-40	5-20
	22-50	Silty clay, silty clay loam, clay.	CL, CH	A-6, A-7	0-15	75-100	75-100	75-95	60-90	35-60	20-40
	50-60	Channery silty clay loam, channery silty clay, channery clay.	CH, CL	A-7, A-6	10-40	65-90	55-90	55-90	50-70	35-60	20-40
	60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
FwD3, FwE3:											
Frondorf	0-10	Silt loam	ML, CL, CL-ML	A-4	0-5	90-100	90-100	85-100	75-100	25-35	5-10
	10-26	Channery silty clay loam, gravelly silt loam, gravelly loam.	ML, CL, GM GC	A-4, A-6, A-2, A-7	10-40	55-90	50-85	40-80	30-75	<45	NP-25
	26	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Wellston	0-8	Silt loam	ML	A-4	0	95-100	90-100	85-100	70-95	25-35	3-10
	8-26	Silt loam, silty clay loam.	CL, CL-ML	A-6, A-4	0-5	75-100	70-100	60-95	60-90	25-40	5-20
	26-55	Silt loam, loam, channery loam.	CL-ML, CL, SC, SM-SC	A-4, A-6	0-10	65-90	65-90	60-90	40-65	20-35	5-15
	55	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Rosine	0-8	Silty clay loam	CL	A-6	0-5	95-100	90-100	85-100	75-95	25-35	11-20
	8-12	Silty clay loam, silt loam.	CL, CL-ML	A-6, A-4	0-5	75-100	70-100	60-95	60-90	25-40	5-20
	12-40	Silty clay, silty clay loam, clay.	CL, CH	A-6, A-7	0-15	75-100	75-100	75-95	60-90	35-60	20-40
	40-50	Channery silty clay loam, channery silty clay, channery clay.	CH, CL	A-7, A-6	10-40	65-90	55-90	55-90	50-70	35-60	20-40
	50	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
He Henshaw	0-9	Silt loam	ML, CL, CL-ML	A-4	0	95-100	95-100	90-100	80-100	20-35	3-10
	9-40	Silty clay loam, silt loam.	CL	A-6, A-4	0	95-100	95-100	95-100	85-100	30-40	8-18
	40-60	Silt loam, silty clay loam.	CL, CL-ML	A-4, A-6	0	95-100	90-100	85-100	75-100	25-40	5-15
HoB2 Hosmer	0-8	Silt loam	ML, CL	A-4, A-6	0	100	100	90-100	80-100	25-35	5-15
	8-30	Silt loam, silty clay loam.	ML, CL-ML, CL	A-4, A-6	0	100	100	90-100	70-90	25-35	5-15
	30-70	Silt loam, silty clay loam.	CL, CL-ML, ML	A-4, A-6	0	100	100	90-100	70-95	20-30	5-15
Ka Karnak	0-10	Silt loam	CL	A-6, A-7	0	100	100	90-100	85-95	30-50	10-25
	10-70	Silty clay, clay	CH, MH, CL ML	A-7	0	100	100	95-100	95-100	45-80	20-40
Kc Karnak	0-8	Silty clay	CH, CL, MH ML	A-7	0	100	100	95-100	95-100	45-80	20-40
	8-60	Silty clay, clay	CH, MH, CL ML	A-7	0	100	100	95-100	95-100	45-80	20-40
Ld Lindside	0-8	Silt loam	ML, CL, CL-ML	A-4, A-6	0	100	95-100	80-100	55-90	20-35	2-15
	8-60	Silty clay loam, silt loam, very fine sandy loam.	CL, ML, CL-ML	A-4, A-6	0	100	95-100	90-100	70-95	25-40	4-18

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Mc---------- McGary	0-9	Silt loam---------	CL-ML, CL	A-4, A-6	0	100	100	90-100	70-90	25-36	5-15
	9-60	Silty clay, silty clay loam, clay.	CL, CH	A-7	0	100	100	95-100	90-100	46-58	24-32
Me---------- Melvin	0-6	Silt loam---------	CL, CL-ML, ML	A-4	0	95-100	90-100	80-100	80-95	25-35	4-10
	6-65	Silt loam, silty clay loam.	CL, CL-ML	A-4, A-6	0	95-100	90-100	80-100	80-95	25-40	5-20
Ne---------- Newark	0-8	Silt loam---------	ML, CL, CL-ML	A-4	0	95-100	90-100	80-100	55-95	<32	NP-10
	8-42	Silt loam, silty clay loam.	ML, CL, CL-ML	A-4, A-6, A-7	0	95-100	90-100	85-100	70-100	22-42	3-20
	42-66	Silt loam, silty clay loam.	ML, CL, CL-ML	A-4, A-6, A-7	0-3	75-100	70-100	65-100	55-95	22-42	3-20
No---------- Nolin	0-9	Silt loam---------	ML, CL, CL-ML	A-4, A-6	0	100	95-100	90-100	80-100	25-40	5-18
	9-65	Silt loam, silty clay loam, loam.	ML, CL, CL-ML	A-4, A-6, A-7	0	100	95-100	85-100	75-100	25-46	5-23
OtA, OtB2-------- Otwell	0-8	Silt loam---------	CL, CL-ML	A-4, A-6	0	100	100	90-100	70-95	25-35	5-15
	8-24	Silty clay loam, silt loam.	CL, CL-ML	A-4, A-6	0	100	100	90-100	70-95	25-40	5-20
	24-40	Silty clay loam, loam, silt loam.	CL	A-6, A-7	0	95-100	95-100	85-100	65-90	35-50	15-30
	40-60	Stratified silt loam and silty clay loam.	CL	A-6, A-7	0	95-100	75-100	75-100	75-95	35-50	15-30
Pi. Pits											
Po---------- Pope	0-8	Fine sandy loam	SM, ML, CL-ML, SM-SC	A-2, A-4	0	85-100	75-100	51-85	25-55	<20	NP-5
	8-30	Fine sandy loam, sandy loam, loam.	SM, SM-SC, ML, CL-ML	A-2, A-4	0	95-100	80-100	51-95	25-75	<30	NP-7
	30-70	Sandy loam, loamy sand.	SM, SM-SC, ML, GM	A-2, A-1, A-4	0-20	45-100	35-100	30-95	15-70	<30	NP-7
RcC2, RcD2: Rosine----------	0-4	Silt loam---------	ML, CL, CL-ML	A-4	0-5	95-100	90-100	85-100	70-95	20-30	3-10
	4-22	Silty clay loam, silt loam.	CL, CL-ML	A-6, A-4	0-5	75-100	70-100	60-95	60-90	25-40	5-20
	22-50	Silty clay, silty clay loam, clay.	CL, CH	A-6, A-7	0-15	75-100	75-100	75-95	60-90	35-60	20-40
	50-60	Channery silty clay loam, channery silty clay, channery clay.	CH, CL	A-7, A-6	10-40	65-90	55-90	55-90	50-70	35-60	20-40
	60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Caneyville------	0-5	Silt loam---------	ML, CL, CL-ML	A-4, A-6	0-3	90-100	85-100	75-100	60-95	20-35	2-12
	5-30	Clay, silty clay	CH	A-7	0-3	90-100	85-100	75-100	65-100	50-75	30-45
	30	Unweathered bedrock.	---	---	---	---	---	---	---	---	---

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
RoC3, RoD3:											
Rosine----------	0-8	Silty clay loam	CL	A-6	0-5	95-100	90-100	85-100	75-95	25-35	11-20
	8-12	Silty clay loam, silt loam.	CL, CL-ML	A-6, A-4	0-5	75-100	70-100	60-95	60-90	25-40	5-20
	12-40	Silty clay, silty clay loam, clay.	CL, CH	A-6, A-7	0-15	75-100	75-100	75-95	60-90	35-60	20-40
	40-50	Channery silty clay loam, channery silty clay, channery clay.	CH, CL	A-7, A-6	10-40	65-90	55-90	55-90	50-70	35-60	20-40
	50	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Caneyville------	0-8	Silty clay-------	CH, CL	A-7	0-3	90-100	85-100	80-100	75-100	45-65	25-45
	8-22	Clay, silty clay	CH	A-7	0-3	90-100	85-100	75-100	65-100	50-75	30-45
	22	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
SaB2----------	0-8	Silt loam--------	ML, CL-ML	A-4	0	95-100	95-100	85-100	80-100	25-35	4-10
Sadler	8-26	Silt loam, silty clay loam.	CL, CL-ML	A-4, A-6	0	95-100	90-100	85-100	75-100	25-40	5-20
	26-45	Silt loam, silty clay loam, loam.	ML, CL, CL-ML	A-4, A-6	0-10	85-100	80-100	70-100	55-95	20-40	2-20
	45-60	Loam, silty clay loam, gravelly loam.	ML, CL, SM GM	A-4, A-6, A-7	0-20	65-100	60-95	50-95	35-90	20-50	2-30
	60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Sf----------	0-8	Silt loam--------	ML	A-4	0	95-100	90-100	80-100	55-95	<35	NP-10
Steff	8-20	Silt loam--------	ML, CL, CL-ML	A-4, A-6	0	95-100	90-100	85-100	70-95	<35	NP-10
	20-60	Silt loam--------	ML, CL-ML, SM, GM	A-4, A-2, A-1	0	80-100	80-100	70-100	50-90	<35	NP-10
Sn----------	0-8	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	90-100	75-90	25-40	5-15
Stendal	8-65	Silt loam, silty clay loam.	CL, CL-ML	A-4, A-6	0	100	100	90-100	75-90	25-40	5-15
Wb----------	0-9	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	85-100	60-90	20-40	5-15
Weinbach	9-22	Silt loam, silty clay loam.	CL	A-4, A-6	0	100	100	90-100	70-90	25-35	8-15
	22-40	Silt loam, silty clay loam, clay loam.	CL	A-4, A-6, A-7	0	100	100	90-100	70-90	25-42	8-20
	40-60	Silty clay loam, silt loam, clay loam.	CL	A-6, A-7	0	100	100	90-100	80-95	30-45	15-25
WeC2, WeD2-------	0-6	Silt loam--------	ML	A-4	0	95-100	90-100	85-100	70-95	25-35	3-10
Wellston	6-36	Silt loam, silty clay loam.	CL, CL-ML	A-6, A-4	0-5	75-100	70-100	60-100	60-100	25-40	5-20
	36-65	Silt loam, loam, channery loam.	CL-ML, CL, SC, SM-SC	A-4, A-6	0-10	65-100	65-100	60-100	40-100	20-35	5-15
	65	Unweathered bedrock.	---	---	---	---	---	---	---	---	---

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
WeC3, WeD3------- Wellston	0-8	Silt loam--------	ML	A-4	0	95-100	90-100	85-100	70-95	25-35	3-10
	8-26	Silt loam, silty clay loam.	CL, CL-ML	A-6, A-4	0-5	75-100	70-100	60-100	60-100	25-40	5-20
	26-55	Silt loam, loam, channery loam.	CL-ML, CL, SC, SM-SC	A-4, A-6	0-10	65-100	65-100	60-100	40-100	20-35	5-15
	55	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
ZaB2, ZaC2------- Zanesville	0-9	Silt loam--------	CL-ML, CL, ML	A-4, A-6	0	95-100	95-100	90-100	80-100	25-40	4-15
	9-30	Silt loam, silty clay loam.	CL, CL-ML	A-4, A-6	0	95-100	95-100	90-100	80-100	25-40	5-20
	30-40	Silt loam, silty clay loam.	ML, CL, CL-ML	A-4, A-6	0-3	90-100	85-100	80-100	60-100	20-40	2-20
	40-65	Sandy clay loam, clay loam, channery sandy clay loam.	SC, CL, SM GM	A-6, A-4, A-2, A-1-b	0-10	65-100	50-95	40-100	20-100	<40	NP-20
	65	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
ZaC3---------- Zanesville	0-8	Silt loam--------	CL-ML, CL, ML	A-4, A-6	0	95-100	95-100	90-100	80-100	25-40	4-15
	8-20	Silt loam, silty clay loam.	CL, CL-ML	A-4, A-6	0	95-100	95-100	90-100	80-100	25-40	5-20
	20-30	Silt loam, silty clay loam, loam.	ML, CL, CL-ML	A-4, A-6	0-3	90-100	85-100	80-100	60-100	20-40	2-20
	30-55	Sandy clay loam, clay loam, channery sandy clay loam.	SC, CL, SM GM	A-6, A-4, A-2, A-1-b	0-10	65-100	50-95	40-100	20-100	<40	NP-20
	55	Unweathered bedrock.	---	---	---	---	---	---	---	---	---

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS

[The symbol < means less than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Organic matter" apply only to the surface layer. Absence of an entry indicates that data were not available or were not estimated]

Map symbol and soil name	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Organic matter
								K	T	
	In	Pct	G/cc	In/hr	In/in	pH				Pct
BfF:										
Bethesda--------	0-6	18-27	1.40-1.55	0.6-2.0	0.10-0.16	3.6-5.5	Low----------	0.32	5	<.5
	6-60	18-40	1.60-1.90	0.2-0.6	0.04-0.13	3.6-5.5	Low----------	0.32		
Fairpoint-------	0-4	18-27	1.40-1.55	0.6-2.0	0.09-0.18	5.6-7.3	Low----------	0.37	5	<.5
	4-60	18-35	1.60-1.80	0.2-0.6	0.03-0.10	5.6-7.3	Moderate-----	0.37		
Morristown------	0-7	18-27	1.45-1.70	0.6-2.0	0.08-0.16	6.6-8.4	Low----------	0.32	5	<.5
	7-70	18-35	1.65-1.90	0.2-0.6	0.03-0.11	6.6-8.4	Moderate-----	0.32		
Bo, Bp----------	0-6	18-27	1.20-1.40	0.6-2.0	0.22-0.24	4.5-7.3	Low----------	0.43	5	1-3
Bonnie	6-60	18-27	1.40-1.60	0.6-2.0	0.20-0.22	4.5-5.5	Low----------	0.43		
Ca----------	0-24	10-30	1.40-1.55	0.6-2.0	0.20-0.23	4.5-6.5	Low----------	0.49	3	.5-2
Calloway	24-40	10-32	1.35-1.55	0.06-0.2	0.09-0.12	4.5-6.0	Moderate-----	0.43		
	40-65	16-32	1.45-1.55	0.06-0.2	0.09-0.12	5.1-7.8	Low----------	0.43		
CcD2----------	0-5	10-27	1.20-1.40	0.6-2.0	0.15-0.22	4.5-6.5	Low----------	0.43	3	2-4
Caneyville	5-30	40-60	1.35-1.60	0.2-0.6	0.12-0.18	5.6-6.5	Moderate-----	0.28		
	30	---	---	---	---	---	----------	----		
Ct----------	0-9	12-27	1.20-1.40	2.0-6.0	0.10-0.18	4.5-5.0	Low----------	0.28	5	1-4
Clifty	9-38	12-27	1.20-1.45	2.0-6.0	0.08-0.16	4.5-5.0	Low----------	0.28		
	38-60	12-35	1.20-1.45	2.0-20	0.05-0.12	4.5-5.0	Low----------	0.28		
Cu----------	0-60	18-25	1.30-1.45	0.6-2.0	0.22-0.24	4.5-7.3	Low----------	0.37	5	1-3
Cuba										
Du.										
Dumps										
EkA, EkB2--------	0-9	10-27	1.20-1.40	0.6-2.0	0.19-0.23	4.5-6.0	Low----------	0.37	5	.5-3
Elk	9-50	18-34	1.20-1.50	0.6-2.0	0.18-0.22	4.5-6.0	Low----------	0.28		
	50-60	15-40	1.20-1.50	0.6-2.0	0.14-0.20	5.1-6.0	Low----------	0.28		
FbB, FbD:										
Fairpoint-------	0-8	18-27	1.35-1.50	0.6-2.0	0.14-0.20	5.6-7.3	Low----------	0.43	3	.5-2
	8-68	18-35	1.60-1.80	0.2-0.6	0.03-0.10	5.6-7.3	Moderate-----	0.32		
Bethesda--------	0-8	18-27	1.35-1.50	0.6-2.0	0.15-0.20	4.5-6.0	Low----------	0.43	3	.5-2
	8-68	18-35	1.60-1.90	0.2-0.6	0.04-0.10	3.6-5.5	Low----------	0.32		
Morristown------	0-8	18-27	1.35-1.50	0.6-2.0	0.15-0.20	6.1-8.4	Low----------	0.43	3	.5-2
	8-78	25-35	1.65-1.90	0.2-0.6	0.03-0.11	7.4-8.4	Moderate-----	0.32		
FmB, FmD:										
Fairpoint-------	0-4	18-27	1.40-1.55	0.6-2.0	0.09-0.18	5.6-7.3	Low----------	0.37	5	<.5
	4-60	18-35	1.60-1.80	0.2-0.6	0.03-0.10	5.6-7.3	Moderate-----	0.37		
Bethesda--------	0-6	18-27	1.40-1.55	0.6-2.0	0.10-0.16	3.6-5.5	Low----------	0.32	5	<.5
	6-60	18-35	1.60-1.90	0.2-0.6	0.04-0.13	3.6-5.5	Low----------	0.32		
Morristown------	0-7	18-27	1.45-1.70	0.6-2.0	0.08-0.16	6.6-8.4	Low----------	0.32	5	<.5
	7-70	25-35	1.65-1.90	0.2-0.6	0.03-0.11	6.6-8.4	Moderate-----	0.32		

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Map symbol and soil name	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Organic matter
								K	T	
	In	Pct	G/cc	In/hr	In/in	pH				Pct
FrF:										
Frondorf	0-20	18-27	1.20-1.40	0.6-2.0	0.18-0.22	4.5-5.5	Low	0.37	3	1-3
	20-36	18-35	1.20-1.45	0.6-2.0	0.08-0.16	4.5-5.5	Low	0.17		
	36	---	---	---	---	---	---	---		
Wellston	0-6	13-27	1.30-1.50	0.6-2.0	0.18-0.22	5.1-6.5	Low	0.37	4	1-3
	6-36	18-35	1.30-1.65	0.6-2.0	0.17-0.21	4.5-6.0	Low	0.37		
	36-65	15-30	1.30-1.60	0.6-2.0	0.12-0.17	4.5-6.0	Low	0.37		
	65	---	---	---	---	---	---	---		
FsD2, FsE:										
Frondorf	0-20	18-27	1.20-1.40	0.6-2.0	0.18-0.22	4.5-5.5	Low	0.37	3	1-3
	20-36	18-35	1.20-1.45	0.6-2.0	0.08-0.16	4.5-5.5	Low	0.17		
	36	---	---	---	---	---	---	---		
Wellston	0-6	13-27	1.30-1.50	0.6-2.0	0.18-0.22	5.1-6.5	Low	0.37	4	1-3
	6-36	18-35	1.30-1.65	0.6-2.0	0.17-0.21	4.5-6.0	Low	0.37		
	36-65	15-30	1.30-1.60	0.6-2.0	0.12-0.17	4.5-6.0	Low	0.37		
	65	---	---	---	---	---	---	---		
Rosine	0-4	13-27	1.30-1.50	0.6-2.0	0.18-0.22	4.5-5.5	Low	0.49	4	1-3
	4-22	22-35	1.35-1.65	0.6-2.0	0.17-0.21	4.5-5.5	Low	0.37		
	22-50	30-50	1.40-1.65	0.2-0.6	0.11-0.18	4.5-5.5	Moderate	0.37		
	50-60	30-50	1.40-1.65	0.2-0.6	0.10-0.16	4.5-6.5	Moderate	0.28		
	60	---	---	---	---	---	---	---		
FwD3, FwE3:										
Frondorf	0-10	18-27	1.20-1.40	0.6-2.0	0.18-0.22	4.5-5.5	Low	0.37	3	1-3
	10-26	18-35	1.20-1.45	0.6-2.0	0.08-0.16	4.5-5.5	Low	0.17		
	26	---	---	---	---	---	---	---		
Wellston	0-8	13-27	1.30-1.50	0.6-2.0	0.18-0.22	5.1-6.5	Low	0.37	4	1-3
	8-26	18-35	1.30-1.65	0.6-2.0	0.17-0.21	4.5-6.0	Low	0.37		
	26-55	15-30	1.30-1.60	0.6-2.0	0.12-0.17	4.5-6.0	Low	0.37		
	55	---	---	---	---	---	---	---		
Rosine	0-8	27-35	1.35-1.55	0.6-2.0	0.17-0.21	4.5-5.5	Low	0.37	3	.5-2
	8-12	22-35	1.35-1.65	0.6-2.0	0.17-0.21	4.5-5.5	Low	0.37		
	12-40	30-50	1.40-1.65	0.2-0.6	0.11-0.18	4.5-5.5	Moderate	0.37		
	40-50	30-50	1.40-1.65	0.2-0.6	0.10-0.16	4.5-6.5	Moderate	0.28		
	50	---	---	---	---	---	---	---		
He	0-9	12-27	1.20-1.40	0.6-2.0	0.18-0.23	5.6-6.5	Low	0.43	4	.5-2
Henshaw	9-40	18-34	1.20-1.40	0.2-0.6	0.15-0.19	5.1-7.3	Low	0.43		
	40-60	15-34	1.20-1.40	0.2-0.6	0.17-0.22	6.6-8.4	Low	0.43		
HoB2	0-30	10-17	1.20-1.40	0.6-2.0	0.22-0.24	4.5-6.5	Low	0.43	4	1-2
Hosmer	30-70	16-26	1.60-1.70	0.06-0.2	0.06-0.08	4.5-6.0	Low	0.43		
Ka	0-10	20-35	1.20-1.40	0.2-0.6	0.19-0.23	5.6-7.3	Moderate	0.32	5	1-3
Karnak	10-70	40-60	1.30-1.50	<0.2	0.09-0.13	5.6-7.3	High	0.32		
Kc	0-8	40-60	1.20-1.40	0.06-0.2	0.11-0.14	5.6-6.0	High	0.32	5	2-3
Karnak	8-60	40-60	1.30-1.50	<0.2	0.09-0.13	5.6-7.3	High	0.32		
Ld	0-8	15-27	1.20-1.40	0.6-2.0	0.20-0.26	5.1-6.5	Low	0.32	5	2-4
Lindside	8-60	18-35	1.20-1.40	0.6-2.0	0.17-0.22	5.1-6.5	Low	0.37		
Mc	0-9	22-27	1.35-1.50	0.6-2.0	0.22-0.24	6.6-7.3	Low	0.43	3	1-4
McGary	9-60	35-50	1.60-1.75	<0.2	0.11-0.13	5.6-7.8	High	0.32		

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Map symbol and soil name	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Organic matter
								K	T	
	In	Pct	G/cc	In/hr	In/in	pH				Pct
Me	0-6	12-17	1.20-1.60	0.6-2.0	0.18-0.23	5.6-7.8	Low	0.43	5	.5-3
Melvin	6-65	12-35	1.30-1.60	0.6-2.0	0.18-0.23	5.6-7.8	Low	0.43		
Ne	0-8	7-27	1.20-1.40	0.6-2.0	0.15-0.23	5.6-7.3	Low	0.43	5	1-4
Newark	8-42	18-35	1.20-1.45	0.6-2.0	0.18-0.23	5.6-7.3	Low	0.43		
	42-66	12-40	1.30-1.50	0.6-2.0	0.15-0.22	5.6-7.3	Low	0.43		
No	0-9	12-35	1.20-1.40	0.6-2.0	0.18-0.23	5.6-7.3	Low	0.43	5	2-4
Nolin	9-65	18-35	1.25-1.50	0.6-2.0	0.18-0.23	5.6-7.3	Low	0.43		
OtA, OtB2	0-8	18-27	1.25-1.40	0.6-2.0	0.22-0.24	4.5-7.3	Low	0.43	3	.5-2
Otwell	8-24	22-30	1.30-1.50	0.6-2.0	0.18-0.22	5.1-5.5	Moderate	0.43		
	24-40	18-30	1.60-1.80	0.06-0.2	0.06-0.08	4.5-5.5	Moderate	0.43		
	40-60	20-30	1.50-1.65	0.06-0.2	0.06-0.08	5.1-5.5	Moderate	0.43		
Pi. Pits										
Po	0-8	5-15	1.20-1.40	2.0-6.0	0.10-0.16	4.5-5.5	Low	0.28	5	1-4
Pope	8-30	5-18	1.30-1.60	0.6-6.0	0.10-0.18	4.5-5.5	Low	0.28		
	30-70	5-20	1.30-1.60	0.6-6.0	0.10-0.18	4.5-5.5	Low	0.28		
RcC2, RcD2:										
Rosine	0-4	13-27	1.30-1.50	0.6-2.0	0.18-0.22	4.5-5.5	Low	0.49	4	1-3
	4-22	22-35	1.35-1.65	0.6-2.0	0.17-0.21	4.5-5.5	Low	0.37		
	22-50	30-50	1.40-1.65	0.2-0.6	0.11-0.18	4.5-5.5	Moderate	0.37		
	50-60	30-50	1.40-1.65	0.2-0.6	0.10-0.16	4.5-6.5	Moderate	0.28		
	60	---	---	---	---	---	---	---		
Caneyville	0-5	10-25	1.20-1.40	0.6-2.0	0.15-0.22	4.5-6.5	Low	0.43	3	2-4
	5-30	40-60	1.35-1.60	0.2-0.6	0.12-0.18	5.6-6.5	Moderate	0.28		
	30	---	---	---	---	---	---	---		
RoC3, RoD3:										
Rosine	0-8	27-35	1.35-1.55	0.6-2.0	0.17-0.21	4.5-5.5	Low	0.37	3	.5-2
	8-12	22-35	1.35-1.65	0.6-2.0	0.17-0.21	4.5-5.5	Low	0.37		
	12-40	30-50	1.40-1.65	0.2-0.6	0.11-0.18	4.5-5.5	Moderate	0.37		
	40-50	30-50	1.40-1.65	0.2-0.6	0.10-0.16	4.5-6.5	Moderate	0.28		
	50	---	---	---	---	---	---	---		
Caneyville	0-8	40-60	1.30-1.55	0.2-0.6	0.13-0.18	4.5-6.5	Moderate	0.32	2	<2
	8-22	40-60	1.35-1.60	0.2-0.6	0.12-0.18	5.6-6.5	Moderate	0.28		
	22	---	---	---	---	---	---	---		
SaB2	0-8	12-27	1.30-1.50	0.6-2.0	0.19-0.23	4.5-5.5	Low	0.43	3	.5-3
Sadler	8-26	18-35	1.35-1.55	0.6-2.0	0.18-0.22	4.5-5.5	Low	0.43		
	26-45	12-35	1.55-1.75	0.06-0.2	0.07-0.12	4.5-5.5	Low	0.43		
	45-60	12-40	1.50-1.70	0.2-2.0	0.07-0.12	4.5-5.5	Low	0.43		
	60	---	---	---	---	---	---	---		
Sf	0-8	12-25	1.30-1.50	0.6-2.0	0.15-0.23	4.5-7.3	Low	0.43	5	1-2
Steff	8-20	12-34	1.30-1.55	0.6-2.0	0.18-0.23	4.5-5.5	Low	0.43		
	20-60	10-25	1.40-1.65	0.6-6.0	0.08-0.21	4.5-5.5	Low	0.43		
Sn	0-8	18-35	1.30-1.45	0.6-2.0	0.22-0.24	4.5-6.5	Low	0.37	5	1-3
Stendal	8-65	18-35	1.45-1.65	0.6-2.0	0.20-0.22	4.5-5.5	Low	0.37		
Wb	0-9	18-27	1.30-1.45	0.6-2.0	0.20-0.24	4.5-7.3	Low	0.43	4	1-3
Weinbach	9-22	20-30	1.40-1.60	0.6-2.0	0.20-0.22	4.5-5.5	Low	0.43		
	22-40	20-30	1.60-1.80	0.06-0.2	0.06-0.08	4.5-5.5	Low	0.43		
	40-60	22-35	1.60-1.80	0.06-0.2	0.14-0.18	4.5-5.5	Moderate	0.43		

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Map symbol and soil name	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Organic matter
								K	T	
	In	Pct	G/cc	In/hr	In/in	pH				Pct
WeC2, WeD2-------	0-6	13-27	1.30-1.50	0.6-2.0	0.18-0.22	5.1-6.5	Low----------	0.37	4	1-3
Wellston	6-36	18-35	1.30-1.65	0.6-2.0	0.17-0.21	4.5-6.0	Low----------	0.37		
	36-65	15-30	1.30-1.60	0.6-2.0	0.12-0.17	4.5-6.0	Low----------	0.37		
	65	---	---	---	---	---	----------	----		
WeC3, WeD3-------	0-8	13-27	1.30-1.50	0.6-2.0	0.18-0.22	5.1-6.5	Low----------	0.37	4	1-3
Wellston	8-26	18-35	1.30-1.65	0.6-2.0	0.17-0.21	4.5-6.0	Low----------	0.37		
	26-55	15-30	1.30-1.60	0.6-2.0	0.12-0.17	4.5-6.0	Low----------	0.37		
	55	---	---	---	---	---	----------	----		
ZaB2, ZaC2-------	0-9	12-27	1.35-1.40	0.6-2.0	0.19-0.23	4.5-5.5	Low----------	0.43	3	1-2
Zanesville	9-30	18-35	1.35-1.45	0.6-2.0	0.17-0.22	4.5-5.5	Low----------	0.37		
	30-40	18-33	1.50-1.75	0.06-0.6	0.08-0.12	4.5-5.5	Low----------	0.37		
	40-65	20-40	1.50-1.70	0.2-2.0	0.08-0.12	4.5-5.5	Low----------	0.28		
	65	---	---	---	---	---	----------	----		
ZaC3-------------	0-8	12-27	1.35-1.40	0.6-2.0	0.19-0.23	4.5-5.5	Low----------	0.43	3	1-2
Zanesville	8-20	18-35	1.35-1.45	0.6-2.0	0.17-0.22	4.5-5.5	Low----------	0.37		
	20-30	18-33	1.50-1.75	0.06-0.6	0.08-0.12	4.5-5.5	Low----------	0.37		
	30-55	20-40	1.50-1.70	0.2-2.0	0.08-0.12	4.5-5.5	Low----------	0.28		
	55	---	---	---	---	---	----------	----		

TABLE 17.--SOIL AND WATER FEATURES

["Flooding" and "water table" and terms such as "rare," "brief," "apparent," and "perched" are explained in the text. The symbol > means more than. Absence of an entry indicates that the feature is not a concern or that data were not estimated]

Map symbol and soil name	Hydrologic group	Flooding			High water table			Bedrock		Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness	Uncoated steel	Concrete
					Ft			In			
BfF:											
Bethesda-------	C	None--------	---	---	>6.0	---	---	>60	---	Moderate	High.
Fairpoint------	C	None--------	---	---	>6.0	---	---	>60	---	High-----	Moderate.
Morristown-----	C	None--------	---	---	>6.0	---	---	>60	---	Moderate	Low.
Bo--------------- Bonnie	C	Occasional	Brief to long.	Jan-Jun	0-1.0	Apparent	Jan-Jun	>60	---	High-----	High.
Bp--------------- Bonnie	D	Frequent----	Long------	Oct-Jun	+2-0.5	Apparent	Sep-Aug	>60	---	High-----	High.
Ca--------------- Calloway	C	None--------	---	---	1.0-2.0	Perched	Jan-Apr	>60	---	High-----	Moderate.
CcD2------------ Caneyville	C	None--------	---	---	>6.0	---	---	20-40	Hard	High-----	Moderate.
Ct--------------- Clifty	B	Occasional	Brief-----	Jan-May	>6.0	---	---	>60	---	Low------	High.
Cu--------------- Cuba	B	Occasional	Brief-----	Jan-May	>6.0	---	---	>60	---	Low------	High.
Du--------------- Dumps	---	None--------	---	---	>6.0	---	---	>60	---	---	---
EkA, EkB2------- Elk	B	Rare--------	---	---	>6.0	---	---	>60	---	Moderate	Moderate.
FbB, FbD, FmB, FmD:											
Fairpoint-----	C	None--------	---	---	>6.0	---	---	>60	---	High-----	Moderate.
Bethesda------	C	None--------	---	---	>6.0	---	---	>60	---	Moderate	High.
Morristown----	C	None--------	---	---	>6.0	---	---	>60	---	Moderate	Low.
FrF:											
Frondorf-------	B	None--------	---	---	>6.0	---	---	20-40	Soft	Moderate	High.
Wellston-------	B	None--------	---	---	>6.0	---	---	>40	Hard	Moderate	High.
FsD2, FwD3, FsE, FwE3:											
Frondorf------	B	None--------	---	---	>6.0	---	---	20-40	Soft	Moderate	High.
Wellston------	B	None--------	---	---	>6.0	---	---	>40	Hard	Moderate	High.
Rosine--------	B	None--------	---	---	>6.0	---	---	>40	Soft	Moderate	High.
He--------------- Henshaw	C	Rare--------	---	---	1.0-2.0	Apparent	Nov-Mar	>60	---	High-----	Moderate.
HoB2------------ Hosmer	C	None--------	---	---	2.0-3.0	Perched	Jan-Apr	>60	---	Moderate	High.

TABLE 17.--SOIL AND WATER FEATURES--Continued

Map symbol and soil name	Hydrologic group	Flooding			High water table			Bedrock		Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness	Uncoated steel	Concrete
					Ft			In			
Ka, Kc---------- Karnak	D	Occasional	Long------	Mar-May	0-3.0	Apparent	Apr-Jun	>60	---	High-----	Moderate.
Ld---------- Lindside	C	Occasional	Brief-----	Dec-Apr	1.5-3.0	Apparent	Dec-Apr	>60	---	Moderate	Low.
Mc---------- McGary	C	Rare--------	---	---	1.0-3.0	Apparent	Jan-Apr	>60	---	High-----	Low.
Me---------- Melvin	D	Occasional	Brief-----	Dec-May	0-1.0	Apparent	Dec-May	>60	---	High-----	Low.
Ne---------- Newark	C	Occasional	Brief-----	Jan-Apr	0.5-1.5	Apparent	Dec-May	>60	---	High-----	Low.
No---------- Nolin	B	Occasional	Brief to long.	Feb-May	3.0-6.0	Apparent	Feb-Mar	>60	---	Low------	Moderate.
OtA, OtB2------- Otwell	C	Rare--------	---	---	2.5-3.5	Perched	Jan-Apr	>60	---	Moderate	High.
Pi---------- Pits	---	None--------	---	---	>6.0	---	---	0	Hard	---	---
Po---------- Pope	B	Occasional	Very brief to brief.	Nov-Apr	>6.0	---	---	>60	---	Low------	High.
RcC2, RcD2, RoC3, RoD3:											
Rosine--------	B	None--------	---	---	>6.0	---	---	>40	Soft	Moderate	High.
Caneyville----	C	None--------	---	---	>6.0	---	---	20-40	Hard	High-----	Moderate.
SaB2---------- Sadler	C	None--------	---	---	1.5-2.0	Perched	Jan-Apr	>50	Hard	Moderate	High.
Sf---------- Steff	C	Occasional	Brief-----	Dec-Apr	1.5-3.0	Apparent	Dec-Apr	>60	---	Moderate	High.
Sn---------- Stendal	C	Occasional	Brief-----	Jan-May	1.0-3.0	Apparent	Jan-Apr	>60	---	High-----	High.
Wb---------- Weinbach	C	Rare--------	---	---	1.0-3.0	Perched	Jan-Apr	>60	---	High-----	High.
WeC2, WeC3, WeD2, WeD3----- Wellston	B	None--------	---	---	>6.0	---	---	>40	Hard	Moderate	High.
ZaB2, ZaC2, ZaC3 Zanesville	C	None--------	---	---	2.0-3.0	Perched	Dec-Apr	>40	Hard	Moderate	High.

TABLE 18.--PHYSICAL ANALYSES OF SELECTED SOILS

Soil name, report number, horizon, and depth (in inches)	Total			Size class and particle diameter (mm)							fi
				Sand					Sand coarser than very fine (2-0.1)	Very fine sand plus silt (0.1-0.002)	>2 mm
	Sand (2-0.05)	Silt (0.05-0.002)	Int. IV Clay (< 0.002)	Very coarse (2-1)	Coarse (1-0.5)	Medium (0.5-0.25)	Fine (0.25-0.1)	Very fine (0.1-0.05)			
				Pct <2 mm							Pct
Bethesda shaly silty clay loam: 1/ (78KY-183-52)											
C1 -- 0- 6	16.4	49.2	34.4	1.4	1.9	2.3	6.0	4.8	11.6	54.0	36.5
C2 -- 6-18	16.1	45.3	38.6	2.5	3.1	1.5	3.9	5.1	11.0	50.4	61.9
C3 -- 18-22	28.7	49.8	21.5	3.8	3.2	2.4	7.5	11.8	16.9	61.6	41.2
C4 -- 22-30	13.4	45.4	41.2	2.4	2.4	1.4	3.5	3.7	9.7	49.1	51.9
C5 -- 30-45	26.5	49.0	24.5	3.5	4.7	3.1	6.5	8.7	17.8	57.7	62.0
C6 -- 45-60	22.1	50.3	27.6	2.7	3.0	2.2	5.4	8.8	13.3	59.1	64.9
Bethesda very channery loam: 2/ (78KY-183-53)											
AC -- 0- 6	31.7	47.1	21.2	0.1	1.1	2.3	17.6	10.6	21.1	57.7	53.1
C1 -- 6-21	27.9	48.8	23.3	0.1	2.8	3.8	11.2	10.0	17.9	58.8	50.6
C2 -- 21-40	25.4	51.8	22.8	0.1	2.3	4.5	9.8	8.7	16.7	60.5	56.6
C3 -- 40-60	23.0	49.6	27.4	0.2	2.7	3.6	8.5	8.0	15.0	57.6	50.6
Morristown shaly silt loam: 3/ (78KY-183-50)											
Ap -- 0- 7	22.6	57.1	20.3	2.1	1.7	1.8	7.1	9.9	12.7	67.0	34.8
C1 -- 7-17	22.9	55.5	21.6	2.1	1.7	1.6	7.3	10.2	12.7	65.7	39.5
C2 -- 17-27	24.7	54.8	20.5	2.3	1.8	1.8	8.2	10.6	14.1	65.4	37.4
C3 -- 27-50	22.5	57.3	20.2	2.1	1.6	1.8	7.8	9.2	13.3	66.5	54.2
C4 -- 50-70	26.0	54.7	19.3	1.9	1.9	2.2	10.2	9.8	16.2	64.5	58.1
Morristown shaly silty clay loam: 4/ (78KY-183-51)											
Ap -- 0- 7	16.9	53.3	29.8	2.5	2.4	1.1	3.9	7.0	9.9	60.3	47.5
C1 -- 7-27	20.0	55.8	24.2	2.8	2.6	1.2	3.9	9.5	10.5	65.3	61.6
C2 -- 27-35	10.2	56.6	33.2	1.3	1.5	0.8	2.6	4.0	6.2	60.6	39.1
C3 -- 35-60	18.1	55.0	26.9	2.6	2.4	1.2	4.1	7.8	10.3	62.8	46.1

1/ Bethesda shaly silty clay loam: 3 miles east of Beaver Dam, 1.5 miles north of McHenry, and Miller Road.

2/ Bethesda very channery loam: Location of pedon sample is the same as that of the pedon given the Bethesda series in "Soil Series and Their Morphology."

3/ Morristown shaly silt loam: Location of pedon sample is the same as that of the pedon given the Morristown series in "Soil Series and Their Morphology."

4/ Morristown shaly silty clay loam: 10 miles south of Beaver Dam, 2 miles south of Cool Spring of Kentucky Highway 369.

TABLE 19.--CHEMICAL ANALYSES OF SELECTED SOILS

Soil name, report number, horizon, and depth (in inches)	Reaction		Extractable cations					Cation exchange capacity		Extractable acidity	Aluminum	Base saturation		Organic matter
	H_2O (1:1)	KCl 1N (1:1)	Ca	Mg	K	Na	Total	Ammonium acetate	Sum of cations			Ammonium acetate	Sum of cations	
	pH	pH	Milliequivalents per 100 grams of soil									Pct	Pct	Pct
Bethesda shaly silty clay loam: 1/ (78KY-183-52)														
C1 -- 0- 6	3.4	2.6	1.2	0.7	0.1	0.2	2.2	12.9	18.6	16.4	1.30	17.1	11.8	2.8
C2 -- 6-18	3.0	2.5	2.0	0.4	0.1	0.4	2.8	14.7	24.0	21.1	2.40	19.7	12.1	9.5
* C2 -- 6-18	3.4	2.7	---	---	---	---	---	---	---	---	---	---	---	---
C3 -- 18-22	3.2	2.6	1.1	0.3	0.1	0.4	1.9	10.2	14.9	13.0	1.70	18.6	12.8	0.7
C4 -- 22-30	3.2	2.6	1.0	0.3	0.2	0.4	1.9	13.2	19.7	17.8	2.10	14.4	9.6	2.8
* C4 -- 22-30	3.9	3.1	---	---	---	---	---	---	---	---	---	---	---	---
C5 -- 30-45	3.1	2.6	6.0	0.1	0.1	0.4	6.6	10.0	30.4	23.8	2.00	66.0	21.7	1.5
C6 -- 45-60	3.2	2.7	5.4	0.6	0.1	0.4	6.4	9.8	25.5	19.0	1.90	66.3	25.5	1.3
Bethesda very channery loam: 2/ ** (78KY-183-53)														
AC -- 0- 6	3.7	2.9	11.2	0.6	0.2	0.3	12.3	9.3	24.4	12.1	0.80	132.3	50.4	3.0
C1 -- 6-21	3.2	2.8	16.1	0.6	0.2	0.2	17.1	9.0	28.3	11.2	1.60	190.0	60.4	2.8
* C1 -- 6-21	3.4	3.0	---	---	---	---	---	---	---	---	---	---	---	---
C2 -- 21-40	3.4	3.0	13.6	0.1	0.1	0.2	14.0	9.2	27.9	13.9	2.30	152.2	50.2	2.0
* C2 -- 21-40	3.7	3.1	---	---	---	---	---	---	---	---	---	---	---	---
C3 -- 40-60	3.7	3.2	14.0	0.1	0.1	0.2	14.4	8.8	24.7	10.3	1.50	163.6	58.3	2.3
Morristown shaly silt loam: 3/ (78KY-183-50)														
Ap -- 0- 7	7.7	7.3	11.7	3.9	0.2	0.3	16.1	6.4	28.9	12.8	0.08	251.6	55.7	3.2
C1 -- 7-17	7.4	7.1	10.4	5.6	0.2	0.4	16.6	6.6	29.6	13.0	0.05	251.5	56.1	3.0
C2 -- 17-27	7.6	7.3	13.1	6.0	0.2	0.5	19.8	6.5	36.1	16.3	0.03	304.6	54.8	3.1
C3 -- 27-50	7.3	6.9	17.3	6.6	0.3	0.6	24.8	6.9	38.5	13.7	0.05	359.4	64.4	2.8
C4 -- 50-70	7.3	6.8	12.6	6.2	0.2	0.7	19.7	7.3	33.6	13.9	0.04	270.0	58.6	2.2
Morristown shaly silty clay loam: 4/ (78KY-183-51)														
Ap -- 0- 7	7.2	6.9	16.6	5.6	0.3	1.5	24.0	9.4	37.0	13.0	0.08	255.3	64.9	3.0
C1 -- 7-27	7.4	7.0	18.5	4.2	0.2	2.1	25.0	8.7	39.8	14.8	0.08	287.4	62.8	3.5
C2 -- 27-35	7.4	7.1	18.2	6.0	0.4	1.2	25.8	10.2	27.9	2.1	0.03	252.7	92.5	2.3
C3 -- 35-60	7.5	7.1	15.4	6.0	0.2	1.4	23.0	9.1	23.7	0.7	0.05	252.7	97.0	2.8

1/ Bethesda shaly silty clay loam: 3 miles east of Beaver Dam, 1.5 miles north of McHenry, and west
Road.

2/ Bethesda very channery loam: Location of pedon sample is the same as that of the pedon given as
Bethesda series in "Soil Series and Their Morphology."

3/ Morristown shaly silt loam: Location of pedon sample is the same as that of the pedon given as t
Morristown series in "Soil Series and Their Morphology."

4/ Morristown shaly silty clay loam: 10 miles south of Beaver Dam, 2 miles south of Cool Springs, 0
Kentucky Highway 369.

* Additional reference samples were taken for these horizons.

** This pedon is a taxadjunct to the Bethesda series because reaction is slightly lower than allowab
series.

TABLE 20.--CLAY MINERALOGY OF SELECTED SOILS
[tr indicates trace]

Soil name, report number, horizon, and depth (in inches)	Percentage of clay minerals										
	Quartz	Potassium feldspar	Biotite	Musco-vite	Plagiclase feldspar	Opaques	Chlorite	Brucite	Calcite	Tourma-line	Plant opal
Bethesda shaly silty clay loam: 1/ (78KY-183-52) C2 -- 6-18	55	4	19	8	6	7	0	0	0	tr	0
Bethesda very channery loam: 2/ (78KY-183-53) C2 -- 21-40	69	3	13	9	3	3	tr	0	0	tr	tr
Morristown shaly silt loam: 3/ (78KY-183-50) C2 -- 17-27	56	2	15	14	4	6	2	1	0	0	0
Morristown shaly silty clay loam: 4/ (78KY-183-51) C1 -- 7-27	70	2	12	3	3	7	tr	0	2	0	0

1/ Bethesda shaly silty clay loam: 3 miles east of Beaver Dam, 1.5 miles north of McHenry, and west side of M

2/ Bethesda very channery loam: Location of pedon sample is the same as that of the pedon given as typical fo series in "Soil Series and Their Morphology."

3/ Morristown shaly silt loam: Location of pedon sample is the same as that of the pedon given as typical for series in "Soil Series and Their Morphology."

4/ Morristown shaly silty clay loam: 10 miles south of Beaver Dam, 2 miles south of Cool Springs, 0.5 mile we Highway 369.

TABLE 21.--ENGINEERING INDEX TEST DATA

[NP means nonplastic]

Soil name, report number, horizon, and depth (in inches)	Classification		Grain-size distribution										Liquid limit	Plasticity index	Moisture density
			Percentage passing sieve--							Percentage smaller than--					
	AASHTO	Unified	2 inch	3/4 inch	3/8 inch	No. 4	No. 10	No. 40	No. 200	.02 mm	.005 mm	.002 mm			Max-dry density
													Pct		Lb/ft^3
Bethesda shaly silty clay loam: 1/ (78KY-183-52)															
C5 -- 30-45	A-4(2)	GC	99	90	79	74	71	65	49	32	21	15	32	9	116
Bethesda very channery loam: 2/ (78KY-183-53)															
C2 -- 21-40	A-4(0)	GC	98	87	76	70	65	59	41	22	16	10	30	8	118
C3 -- 40-60	A-4(1)	SC	100	99	81	75	70	61	43	28	24	17	30	9	116
Morristown shaly silt loam: 3/ (78KY-183-50)															
C3 -- 27-50	A-6(1)	SC	99	88	79	76	70	63	40	31	20	16	31	11	122
Morristown shaly silty clay loam: 4/ (78KY-183-51)															
C1 -- 7-27	A-6(3)	SC	100	96	88	84	79	68	49	29	23	20	32	12	120
Newark silt loam: 5/ (77KY-183-13)															
Bw -- 8-14	A-4(9)	CL	100	100	100	100	100	100	98	74	35	18	30	10	108
Bg -- 14-42	A-4(5)	CL-ML	100	100	100	100	100	100	92	56	27	15	27	7	108
Steff silt loam: 6/ (77KY-183-5)															
Bw1 -- 8-20	A-4(0)	ML	100	100	100	100	100	100	92	47	14	11	NP	NP	104
Bw2 -- 20-50	A-4(0)	ML	100	100	100	100	100	97	88	47	14	11	NP	NP	106
Wellston silt loam: 7/ (77KY-183-2)															
Bt2 -- 18-36	A-6(15)	CL	100	100	100	100	100	100	98	61	34	25	38	14	106
2C -- 45-65	A-4(11)	ML	100	100	100	100	100	100	98	60	27	18	35	10	104

TABLE 21.--ENGINEERING INDEX TEST DATA--Continued

Soil name, report number, horizon, and depth (in inches)	Classification		Grain-size distribution										Liquid limit	Plasticity index	Mois den
			Percentage passing sieve--							Percentage smaller than--					Max-dry density
	AASHTO	Unified	2 inch	3/4 inch	3/8 inch	No. 4	No. 10	No. 40	No. 200	.02 mm	.005 mm	.002 mm			
													Pct		Lb/ft^3
Zanesville silt loam: 8/ (77KY-183-14)															
Bt1 -- 9-24	A-6(15)	CL	100	100	100	100	100	100	100	66	34	25	36	14	106
Btx -- 30-40	A-4(5)	CL	100	100	100	100	100	99	80	53	22	18	27	9	111
2C1 -- 40-60	A-4(0)	CL-ML	100	100	100	100	100	99	80	50	21	11	17	4	122

1/ Bethesda shaly silty clay loam: 3 miles east of Beaver Dam, 1.5 miles north of McHenry, and west side o

2/ Bethesda very channery loam: Location of pedon sample is the same as that of the pedon given as typica Bethesda series in "Soil Series and Their Morphology."

3/ Morristown shaly silt loam: Location of pedon sample is the same as that of the pedon given as typical Morristown series in "Soil Series and Their Morphology."

4/ Morristown shaly silty clay loam: 10 miles south of Beaver Dam, 2 miles south of Cool Springs, 0.5 mil Kentucky Highway 369.

5/ Newark silt loam: Location of pedon sample is the same as that of the pedon given as typical for the N "Soil Series and Their Morphology."

6/ Steff silt loam: Location of pedon sample is the same as that of the pedon given as typical for the St "Soil Series and Their Morphology."

7/ Wellston silt loam: Location of pedon sample is the same as that of the pedon given as typical for the in "Soil Series and Their Morphology."

8/ Zanesville silt loam: Location of pedon sample is the same as that of the pedon given as typical for t series in "Soil Series and Their Morphology."

TABLE 22.--CLASSIFICATION OF THE SOILS

Soil name	Family or higher taxonomic class
Bethesda	Loamy-skeletal, mixed, acid, mesic Typic Udorthents
Bonnie	Fine-silty, mixed, acid, mesic Typic Fluvaquents
*Calloway	Fine-silty, mixed, thermic Glossaquic Fragiudalfs
Caneyville	Fine, mixed, mesic Typic Hapludalfs
*Clifty	Fine-loamy, mixed, mesic Fluventic Dystrochrepts
Cuba	Fine-silty, mixed, mesic Fluventic Dystrochrepts
Elk	Fine-silty, mixed, mesic Ultic Hapludalfs
Fairpoint	Loamy-skeletal, mixed, nonacid, mesic Typic Udorthents
Frondorf	Fine-loamy, mixed, mesic Ultic Hapludalfs
Henshaw	Fine-silty, mixed, mesic Aquic Hapludalfs
Hosmer	Fine-silty, mixed, mesic Typic Fragiudalfs
Karnak	Fine, montmorillonitic, nonacid, mesic Vertic Haplaquepts
Lindside	Fine-silty, mixed, mesic Fluvaquentic Eutrochrepts
McGary	Fine, mixed, mesic Aeric Ochraqualfs
Melvin	Fine-silty, mixed, nonacid, mesic Typic Fluvaquents
Morristown	Loamy-skeletal, mixed (calcareous), mesic Typic Udorthents
Newark	Fine-silty, mixed, nonacid, mesic Aeric Fluvaquents
Nolin	Fine-silty, mixed, mesic Dystric Fluventic Eutrochrepts
Otwell	Fine-silty, mixed, mesic Typic Fragiudalfs
Pope	Coarse-loamy, mixed, mesic Fluventic Dystrochrepts
Rosine	Fine-silty, mixed, mesic Ultic Hapludalfs
Sadler	Fine-silty, mixed, mesic Glossic Fragiudalfs
Steff	Fine-silty, mixed, mesic Fluvaquentic Dystrochrepts
Stendal	Fine-silty, mixed, acid, mesic Aeric Fluvaquents
Weinbach	Fine-silty, mixed, mesic Aeric Fragiaqualfs
Wellston	Fine-silty, mixed, mesic Ultic Hapludalfs
Zanesville	Fine-silty, mixed, mesic Typic Fragiudalfs

* The soil is a taxadjunct to the series. See text for description of those characteristics of the soil that are outside the range of the series.

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All Other Inquiries

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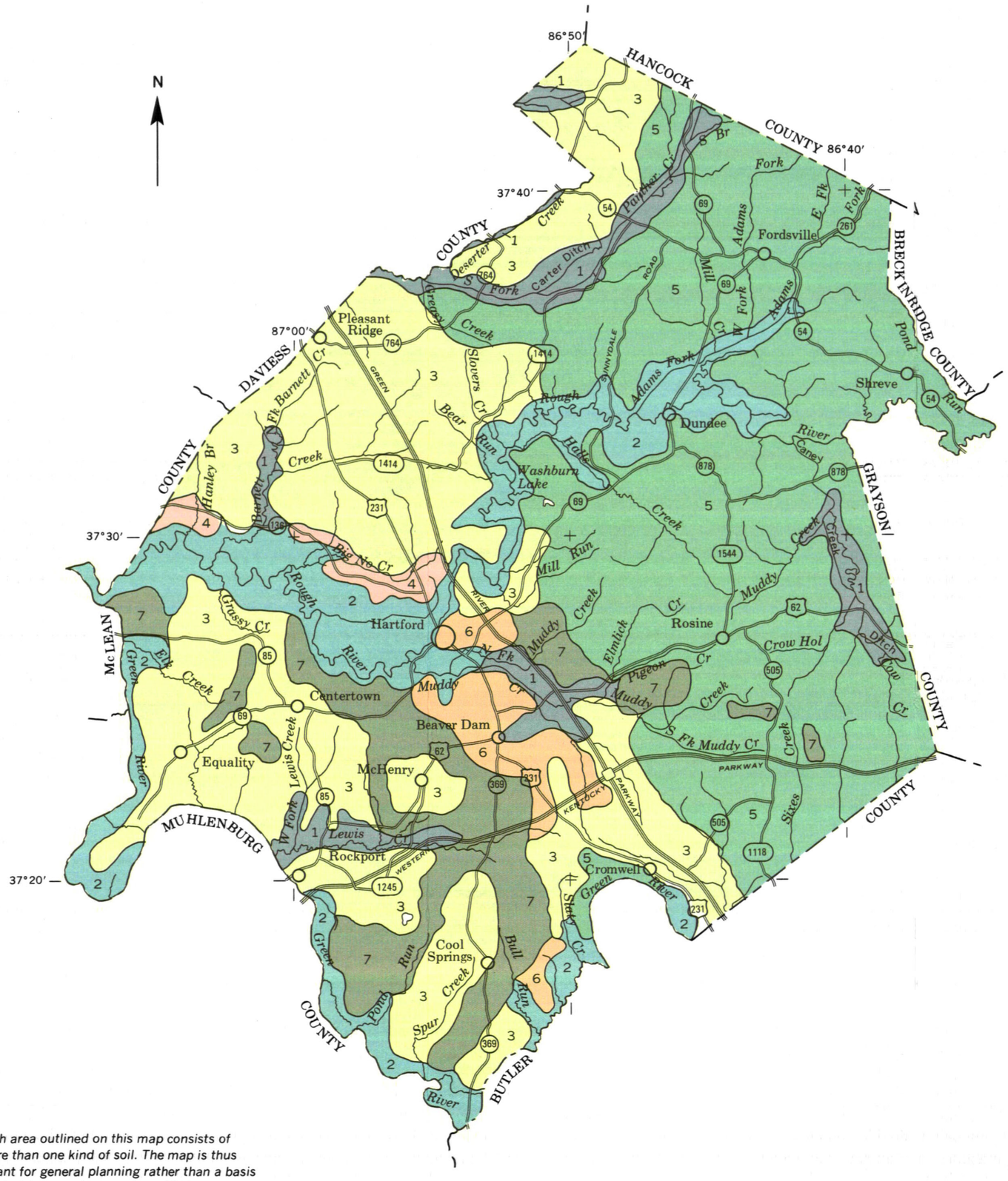


LEGEND*

1	STENDAL-BONNIE-STEFF: Deep, nearly level, moderately well drained to poorly drained, medium textured soils; on flood plains
2	MELVIN-NEWARK-KARNAK: Deep, nearly level, somewhat poorly drained and poorly drained,medium textured and fine textured soils; on flood plains
3	WELLSTON-ZANESVILLE: Deep, gently sloping to moderately steep, well drained and moderately well drained, medium textured soils; on uplands
4	HOSMER-ZANESVILLE: Deep, gently sloping and sloping, moderately well drained and well drained, medium textured soils; on uplands
5	FRONDORF-ZANESVILLE-WELLSTON: Deep and moderately deep, gently sloping to very steep, well drained and moderately well drained, medium textured soils; on uplands
6	SADLER-ZANESVILLE-WELLSTON: Deep, gently sloping to steep, moderately well drained and well drained, medium textured soils; on uplands
7	BETHESDA-FAIRPOINT-ZANESVILLE: Deep, gently sloping to very steep, moderately well drained and well drained, medium textured soils; on uplands

*The texture given in the descriptive heading refers to the texture of the surface layer of the major soil in each map unit.

Compiled 1985

Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts.

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
KENTUCKY NATURAL RESOURCES AND ENVIRONMENTAL PROTECTION CABINET
KENTUCKY AGRICULTURAL EXPERIMENT STATION

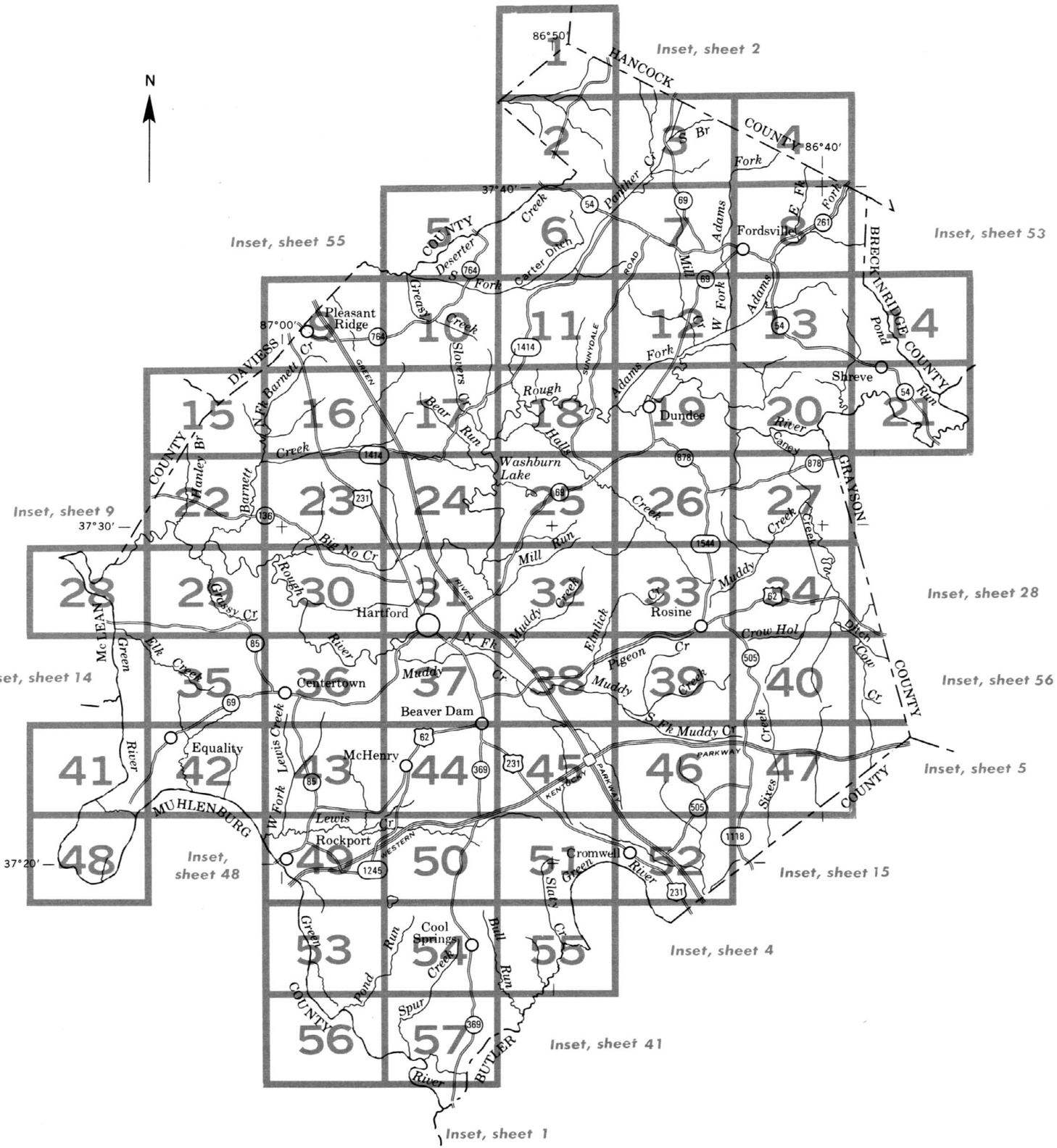
GENERAL SOIL MAP

OHIO COUNTY, KENTUCKY

Scale 1:253,440

1 0 1 2 3 4 Miles

1 0 4 8 Km



INDEX TO MAP SHEETS

OHIO COUNTY, KENTUCKY

Scale 1:253,440

1 0 1 2 3 4 Miles

1 0 4 8 Km

SOIL LEGEND

The first letter, always a capital, is the initial letter of the soil name. The second letter is a small letter connotative of the soil name if possible. The third, if used, is a capital letter and indicates the slope class. Symbols without a slope letter are nearly level, except for Dumps, mine and Pits, quarry, which are not soil and have variable slopes. If the number 2 is added to the symbol it indicates that the soil is moderately eroded, and 3 indicates severe erosion. Symbols without a number indicate none to slight erosion.

SYMBOL	NAME
BfF	Bethesda, Fairpoint, and Morristown soils, 20 to 70 percent slopes
Bo	Bonnie silt loam, occasionally flooded
Bp	Bonnie silt loam, ponded
Ca	Calloway silt loam
CcD2	Caneyville silt loam, very rocky, 8 to 20 percent slopes, eroded
Ct	Clifty gravelly silt loam, occasionally flooded
Cu	Cuba silt loam, occasionally flooded
Du	Dumps, mine
EkA	Elk silt loam, 0 to 2 percent slopes
EkB2	Elk silt loam, 2 to 6 percent slopes, eroded
FbB	Fairpoint, Bethesda, and Morristown silt loams, 0 to 6 percent slopes
FbD	Fairpoint, Bethesda, and Morristown silt loams, 6 to 20 percent slopes
FmB	Fairpoint, Bethesda, and Morristown soils, 0 to 6 percent slopes
FmD	Fairpoint, Bethesda, and Morristown soils, 6 to 20 percent slopes
FrF	Frondorf-Wellston silt loams, 30 to 50 percent slopes
FsD2	Frondorf-Wellston-Rosine silt loams, 12 to 20 percent slopes, eroded
FsE	Frondorf-Wellston-Rosine silt loams, 20 to 30 percent slopes
FwD3	Frondorf-Wellston-Rosine complex, 12 to 20 percent slopes, severely eroded
FwE3	Frondorf-Wellston-Rosine complex, 20 to 30 percent slopes, severely eroded
He	Henshaw silt loam
HoB2	Hosmer silt loam, 2 to 6 percent slopes, eroded
Ka	Karnak silt loam, overwash, occasionally flooded
Kc	Karnak silty clay, occasionally flooded
Ld	Lindside silt loam, occasionally flooded
Mc	McGary silt loam
Me	Melvin silt loam, occasionally flooded
Ne	Newark silt loam, occasionally flooded
No	Nolin silt loam, occasionally flooded
OtA	Otwell silt loam, 0 to 2 percent slopes
OtB2	Otwell silt loam, 2 to 6 percent slopes, eroded
Po	Pope fine sandy loam, occasionally flooded
Pi	Pits, quarry
RcC2	Rosine and Caneyville silt loams, 6 to 12 percent slopes, eroded
RcD2	Rosine and Caneyville silt loams, 12 to 20 percent slopes, eroded
RoC3	Rosine and Caneyville soils, 6 to 12 percent slopes, severely eroded
RoD3	Rosine and Caneyville soils, 12 to 20 percent slopes, severely eroded
SaB2	Sadler silt loam, 2 to 6 percent slopes, eroded
Sf	Steff silt loam, occasionally flooded
Sn	Stendal silt loam, occasionally flooded
Wb	Weinbach silt loam
WeC2	Wellston silt loam, 6 to 12 percent slopes, eroded
WeC3	Wellston silt loam, 6 to 12 percent slopes, severely eroded
WeD2	Wellston silt loam, 12 to 20 percent slopes, eroded
WeD3	Wellston silt loam, 12 to 20 percent slopes, severely eroded
ZaB2	Zanesville silt loam, 2 to 6 percent slopes, eroded
ZaC2	Zanesville silt loam, 6 to 12 percent slopes, eroded
ZaC3	Zanesville silt loam, 6 to 12 percent slopes, severely eroded

CONVENTIONAL AND SPECIAL SYMBOLS LEGEND

CULTURAL FEATURES

BOUNDARIES

- National, state or province
- County or parish
- Minor civil division
- Reservation (national forest or park, state forest or park, and large airport)
- Land grant
- Limit of soil survey (label)
- Field sheet matchline & neatline
- AD HOC BOUNDARY (label) — Medley Airstrip
- Small airport, airfield, park, oilfield, cemetery, or flood pool — FLOOD POOL LINE
- STATE COORDINATE TICK
- LAND DIVISION CORNERS (sections and land grants)

ROADS

- Divided (median shown if scale permits)
- Other roads
- Trail

ROAD EMBLEM & DESIGNATIONS

- Interstate — 21
- Federal — 173
- State — 28
- County, farm or ranch — 1283

- RAILROAD
- POWER TRANSMISSION LINE (normally not shown)
- PIPE LINE (normally not shown)
- FENCE (normally not shown)

LEVEES

- Without road
- With road
- With railroad

DAMS

- Large (to scale)
- Medium or small — water, w

PITS

- Gravel pit
- Mine or quarry

MISCELLANEOUS CULTURAL FEATURES

- Farmstead, house (omit in urban areas)
- Church
- School
- Indian mound (label) — Indian Mound
- Located object (label) — Tower
- Tank (label) — Gas
- Wells, oil or gas
- Windmill
- Kitchen midden

WATER FEATURES

DRAINAGE

- Perennial, double line
- Perennial, single line
- Intermittent
- Drainage end
- Canals or ditches
  - Double-line (label) — CANAL
  - Drainage and/or irrigation

LAKES, PONDS AND RESERVOIRS

- Perennial — water, w
- Intermittent — int i, i

MISCELLANEOUS WATER FEATURES

- Marsh or swamp
- Spring
- Well, artesian
- Well, irrigation
- Wet spot

SPECIAL SYMBOLS FOR SOIL SURVEY

- SOIL DELINEATIONS AND SYMBOLS — CnB, WaC2
- ESCARPMENTS
  - Bedrock (points down slope)
  - Other than bedrock (points down slope)
- SHORT STEEP SLOPE
- GULLY
- DEPRESSION OR SINK
- SOIL SAMPLE SITE (normally not shown) — S
- MISCELLANEOUS
  - Blowout
  - Clay spot
  - Gravelly spot
  - Gumbo, slick or scabby spot (sodic)
  - Dumps and other similar non soil areas
  - Prominent hill or peak
  - Rock outcrop (includes sandstone and shale)
  - Saline spot
  - Sandy spot
  - Severely eroded spot
  - Slide or slip (tips point upslope)
  - Stony spot, very stony spot — 0

OHIO COUNTY, KENTUCKY — SHEET NUMBER 1

OHIO COUNTY, KENTUCKY NO. 1

This soil survey map was compiled by the U. S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1979 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

1 680 000 FEET

520 000 FEET

1 665 000 FEET

(Joins sheet 57)

326 000 FEET

322 000 FEET

1 670 000 FEET

4000 AND 5000-FOOT GRID TICKS

MUHLENBERG COUNTY

Green River

BUTLER COUNTY

DAVIESS COUNTY

HANCOCK COUNTY

Panther Creek

North Fork

Herbert

(Joins sheet 2)

505 000 FEET

1 695 000 FEET

(Joins inset, sheet 2)

1

N

5000 Feet

1 Kilometer

Scale - 1:20000

OHIO COUNTY, KENTUCKY — SHEET NUMBER 2

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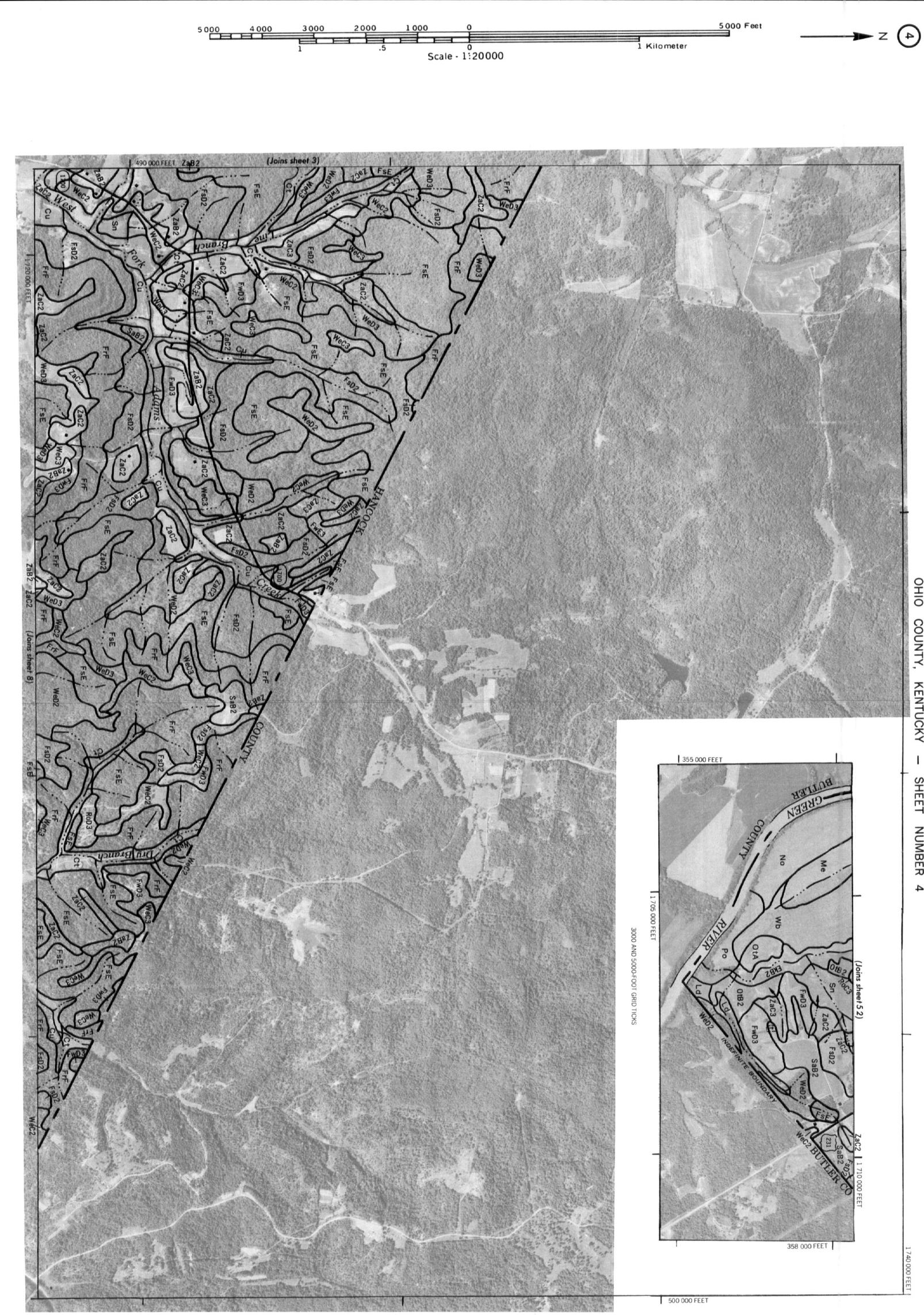
OHIO COUNTY, KENTUCKY — SHEET NUMBER 3

5000 4000 3000 2000 1000 0 5000 Feet

1 .5 0 1 Kilometer

Scale 1:20000

N



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OHIO COUNTY, KENTUCKY — SHEET NUMBER 5

5000 4000 3000 2000 1000 0 5000 Feet

1 .5 0 1 Kilometer

Scale 1:20000

N

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OHIO COUNTY, KENTUCKY NO. 7

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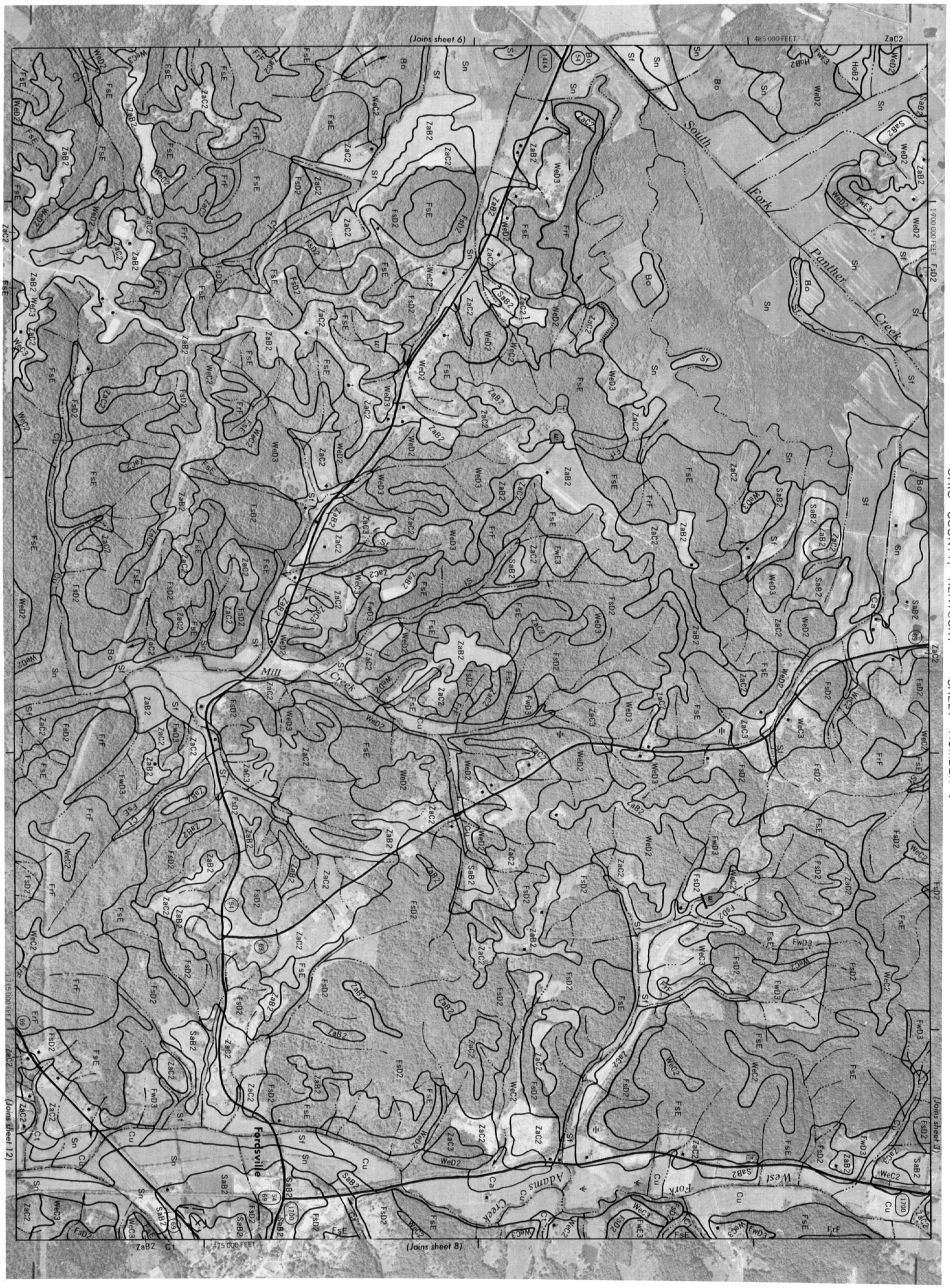

OHIO COUNTY, KENTUCKY — SHEET NUMBER 7

5000 4000 3000 2000 1000 0 5000 Feet

1 .5 0 1 Kilometer

Scale - 1:20000

N

OHIO COUNTY, KENTUCKY — SHEET NUMBER 8

8

N

Scale - 1:20000

0 5000 Feet 1 Kilometer

0 1000 2000 3000 4000 5000

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OHIO COUNTY, KENTUCKY NO. 8

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OHIO COUNTY, KENTUCKY — SHEET NUMBER 9

5000 4000 3000 2000 1000 0 5000 Feet

1 .5 0 1 Kilometer

Scale - 1:20000

N

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OHIO COUNTY, KENTUCKY NO. 10

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5000 4000 3000 2000 1000 0 5000 Feet

1 .5 0 1 Kilometer

Scale - 1:20000

N

OHIO COUNTY, KENTUCKY — SHEET NUMBER 12

This soil survey map was compiled by the U. S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1979 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

OHIO COUNTY, KENTUCKY NO. 12

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OHIO COUNTY, KENTUCKY — SHEET NUMBER 13

5000 4000 3000 2000 1000 0 5000 Feet

1 .5 0 1 Kilometer

Scale - 1:20000

N

OHIO COUNTY, KENTUCKY — SHEET NUMBER 14

This soil survey map was compiled by the U. S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1979 aerial photography Coordinate grid ticks and land division corners, if shown, are approximately positioned.

OHIO COUNTY, KENTUCKY NO. 14

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5000 4000 3000 2000 1000 0 5000 Feet

1 .5 0 1 Kilometer

Scale - 1:20000

N

15

OHIO COUNTY, KENTUCKY — SHEET NUMBER 15

OHIO COUNTY, KENTUCKY — SHEET NUMBER 16

This soil survey map was compiled by the U. S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1979 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

OHIO COUNTY, KENTUCKY NO. 16

17

OHIO COUNTY, KENTUCKY NO. 17

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N

5 000 Feet
1 Kilometer
0 1 000 2000 3000 4000 5 000
0 .5 1
Scale - 1:20000

5000 4000 3000 2000 1000 0 5000 Feet

1 .5 0 1 Kilometer

Scale - 1:20000

N

OHIO COUNTY, KENTUCKY — SHEET NUMBER 18

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OHIO COUNTY, KENTUCKY — SHEET NUMBER 19

5000 4000 3000 2000 1000 0 5000 Feet

1 .5 0 1 Kilometer

Scale - 1:20000

N

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5000 4000 3000 2000 1000 0 5000 Feet

1 .5 0 1 Kilometer

Scale - 1:20000

N

21

OHIO COUNTY, KENTUCKY — SHEET NUMBER 21

OHIO COUNTY, KENTUCKY — SHEET NUMBER 22

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OHIO COUNTY, KENTUCKY — SHEET NUMBER 23

5000 4000 3000 2000 1000 0 5000 Feet

1 .5 0 1 Kilometer

Scale - 1:20000

N

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5000 4000 3000 2000 1000 0 5000 Feet

1 .5 0 1 Kilometer

Scale - 1:20000

N

25

OHIO COUNTY, KENTUCKY — SHEET NUMBER 25

5000 4000 3000 2000 1000 0 5000 Feet

1 .5 0 1 Kilometer

Scale - 1:20000

N

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OHIO COUNTY, KENTUCKY — SHEET NUMBER 27

5000 4000 3000 2000 1000 0 5000 Feet

1 .5 0 1 Kilometer

Scale - 1:20000

N

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OHIO COUNTY, KENTUCKY NO. 28

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OHIO COUNTY, KENTUCKY — SHEET NUMBER 29

5000 4000 3000 2000 1000 0 5000 Feet

1 .5 0 1 Kilometer

Scale - 1:20000

N

This soil survey map was compiled by the U. S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1979 aerial photography Coordinate grid ticks and land division corners, if shown, are approximately positioned.

OHIO COUNTY, KENTUCKY NO. 30

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OHIO COUNTY, KENTUCKY — SHEET NUMBER 31

5000 4000 3000 2000 1000 0 5000 Feet

1 .5 0 1 Kilometer

Scale - 1:20000

N

5000 4000 3000 2000 1000 0 5000 Feet

1 .5 0 1 Kilometer

Scale - 1:20000

N

OHIO COUNTY, KENTUCKY — SHEET NUMBER 32

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OHIO COUNTY, KENTUCKY — SHEET NUMBER 33

5 000 4 000 3 000 2 000 1 000 0 5 000 Feet

1 .5 0 1 Kilometer

Scale - 1:20000

N

OHIO COUNTY, KENTUCKY — SHEET NUMBER 34

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OHIO COUNTY, KENTUCKY — SHEET NUMBER 35

5000 4000 3000 2000 1000 0 5000 Feet

1 .5 0 1 Kilometer

Scale - 1:20000

N

OHIO COUNTY, KENTUCKY — SHEET NUMBER 36

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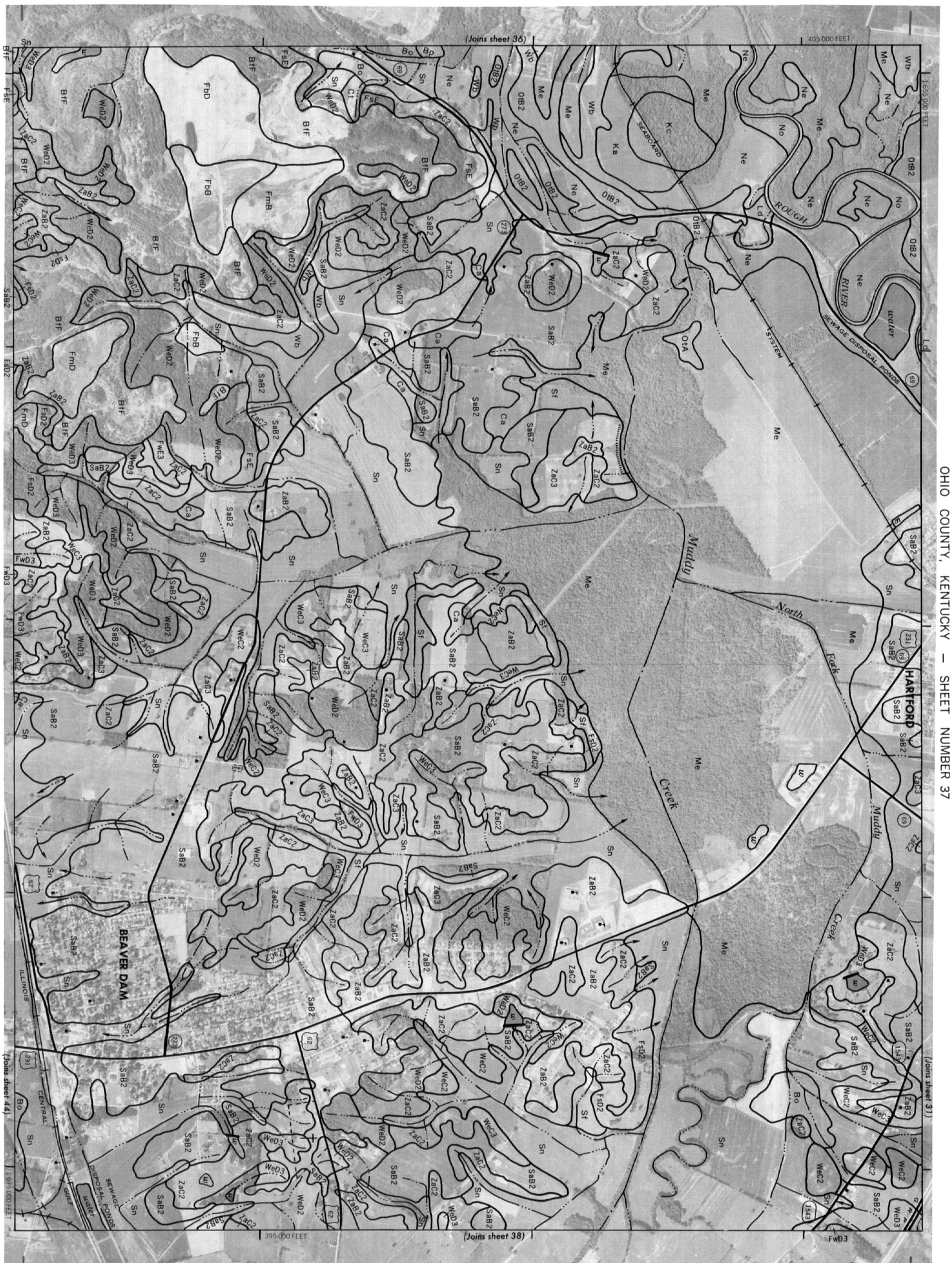

OHIO COUNTY, KENTUCKY — SHEET NUMBER 37

5000 4000 3000 2000 1000 0 5000 Feet

1 .5 0 1 Kilometer

Scale - 1:20000

N

OHIO COUNTY, KENTUCKY — SHEET NUMBER 38

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OHIO COUNTY, KENTUCKY — SHEET NUMBER 39

5000 4000 3000 2000 1000 0 5000 Feet

1 .5 0 1 Kilometer

Scale - 1:20000

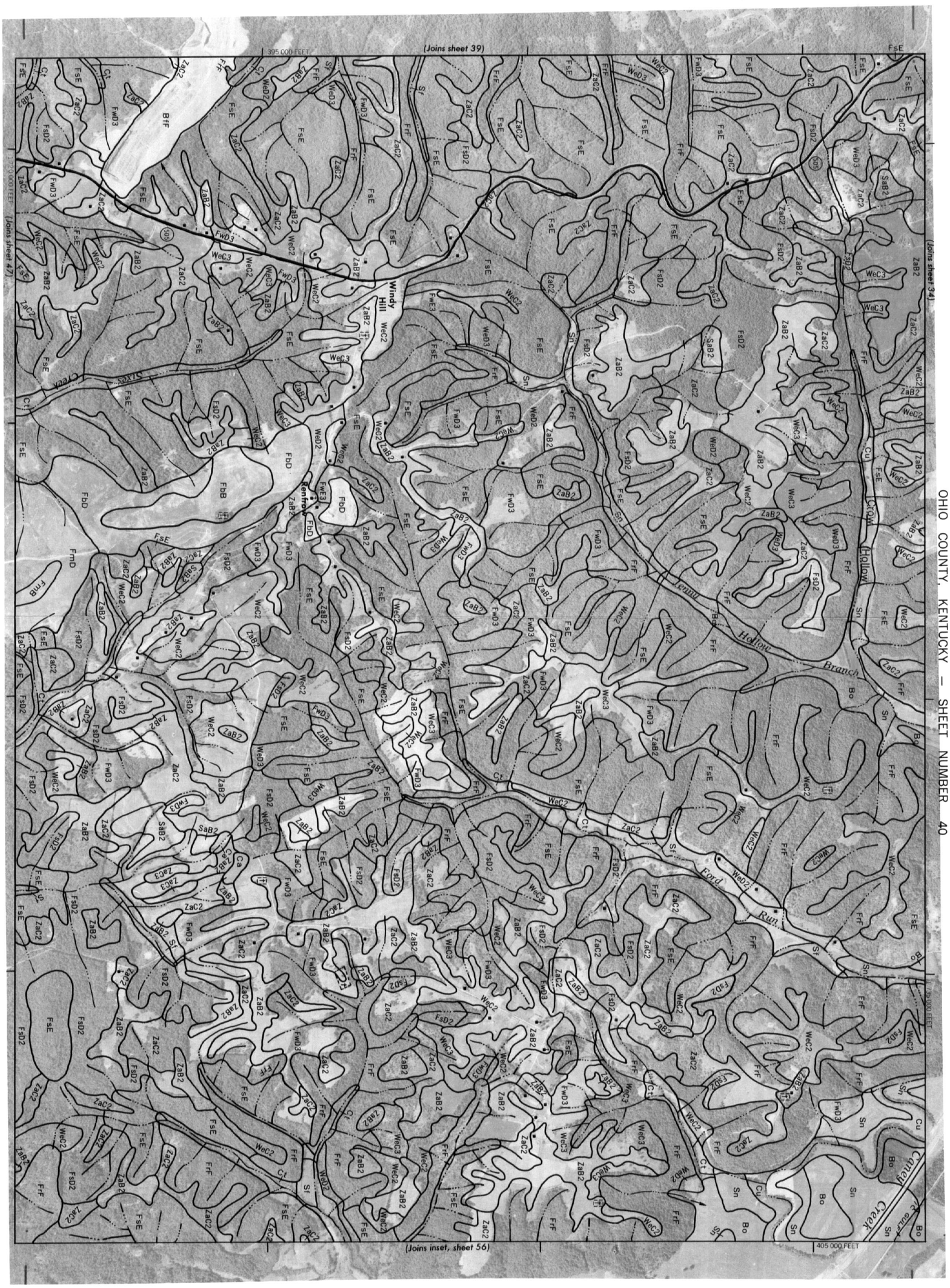
N

5000 4000 3000 2000 1000 0 5000 Feet

1 .5 0 1 Kilometer

Scale - 1:20000

N



OHIO COUNTY, KENTUCKY — SHEET NUMBER 40

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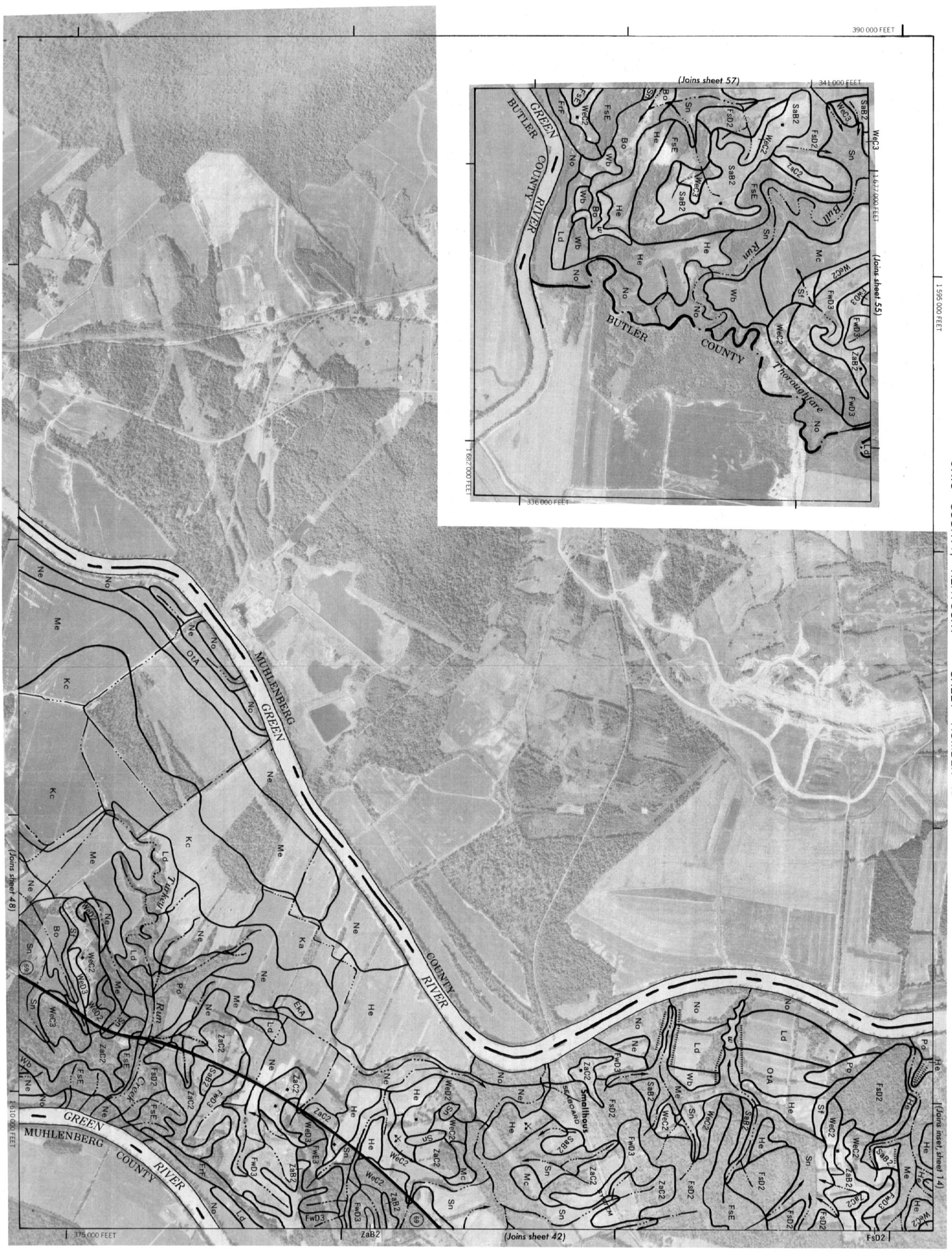

5000 4000 3000 2000 1000 0 5000 Feet

1 .5 0 1 Kilometer

Scale - 1:20000

N

41

OHIO COUNTY, KENTUCKY — SHEET NUMBER 41

5000 4000 3000 2000 1000 0 5000 Feet

1 .5 0 1 Kilometer

Scale - 1:20000

N

OHIO COUNTY, KENTUCKY — SHEET NUMBER 42

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OHIO COUNTY, KENTUCKY — SHEET NUMBER 43

5000 4000 3000 2000 1000 0 5000 Feet

1 .5 0 1 Kilometer

Scale - 1:20000

N

5000 4000 3000 2000 1000 0 5000 Feet

1 .5 0 1 Kilometer

Scale - 1:20000

N

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OHIO COUNTY, KENTUCKY NO. 44

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5000 4000 3000 2000 1000 0 5000 Feet

1 .5 0 1 Kilometer

Scale - 1:20000

N

5000 4000 3000 2000 1000 0 5000 Feet

1 .5 0 1 Kilometer

Scale - 1:20000

N

OHIO COUNTY, KENTUCKY — SHEET NUMBER 46

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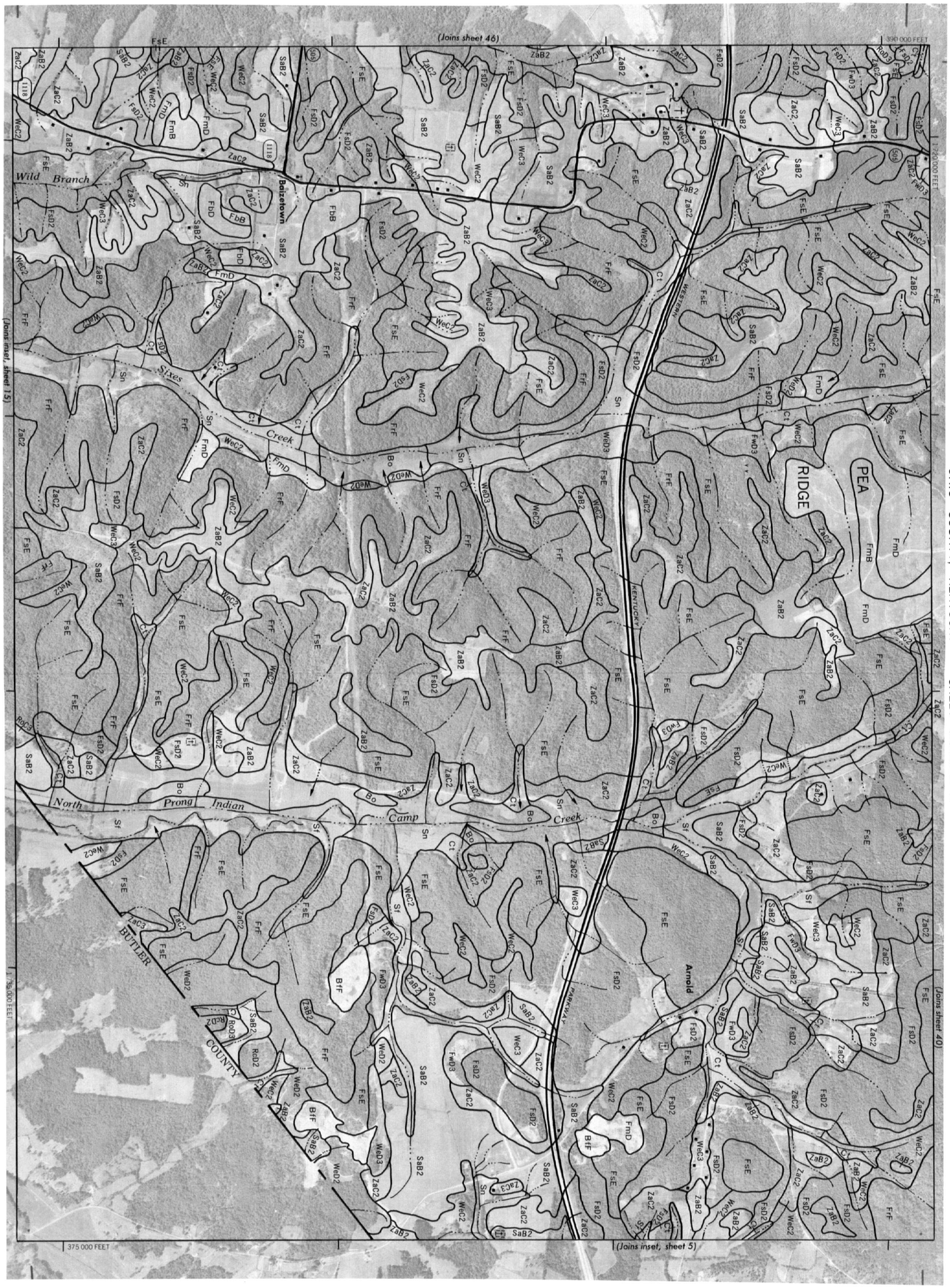


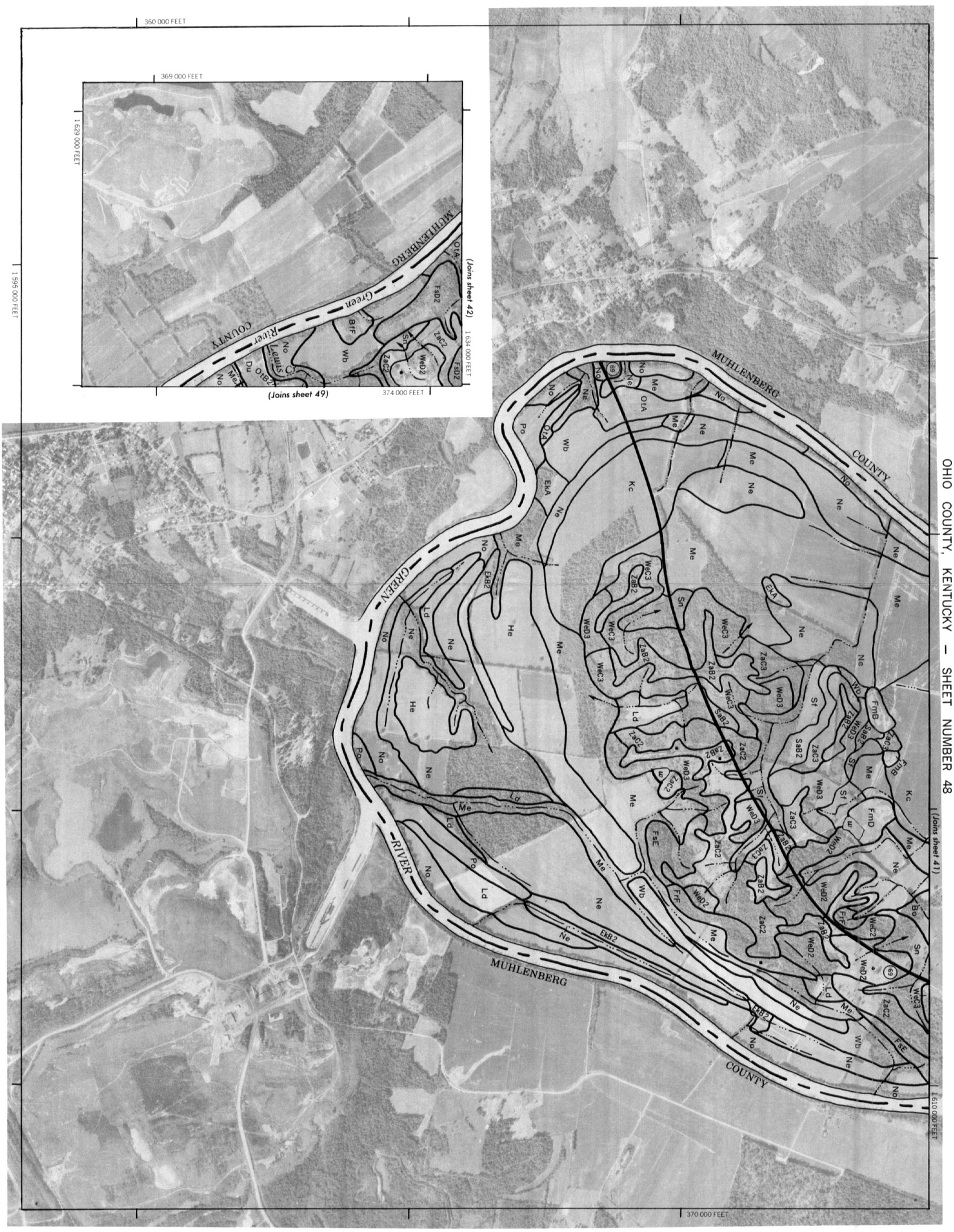
OHIO COUNTY, KENTUCKY — SHEET NUMBER 47

5000 4000 3000 2000 1000 0 5000 Feet

1 .5 0 1 Kilometer

Scale 1:20000

N



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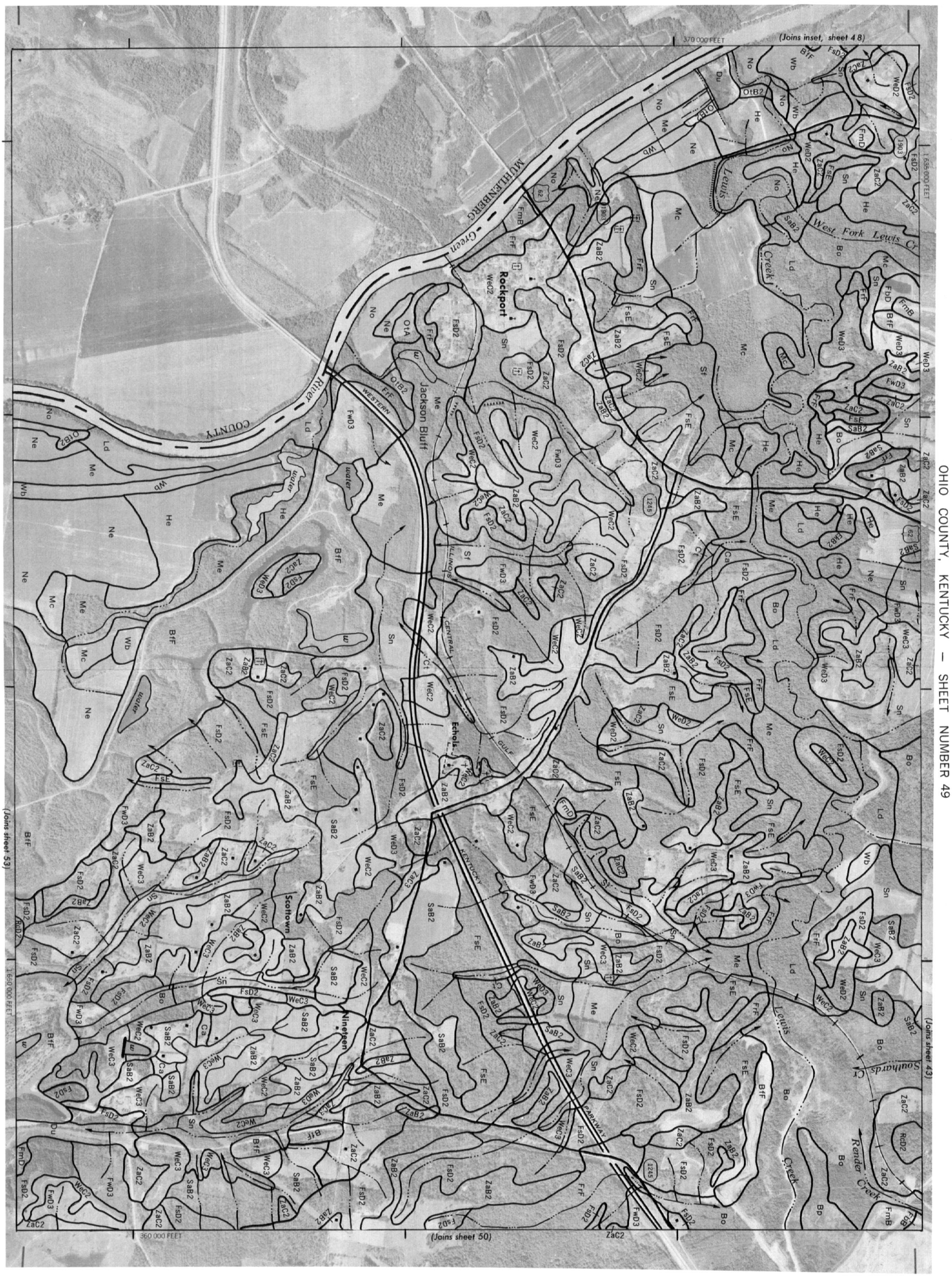

OHIO COUNTY, KENTUCKY — SHEET NUMBER 49

5000 4000 3000 2000 1000 0 5000 Feet

1 .5 0 1 Kilometer

Scale - 1:20000

N

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5000 4000 3000 2000 1000 0 5000 Feet

1 .5 0 1 Kilometer

Scale - 1:20000

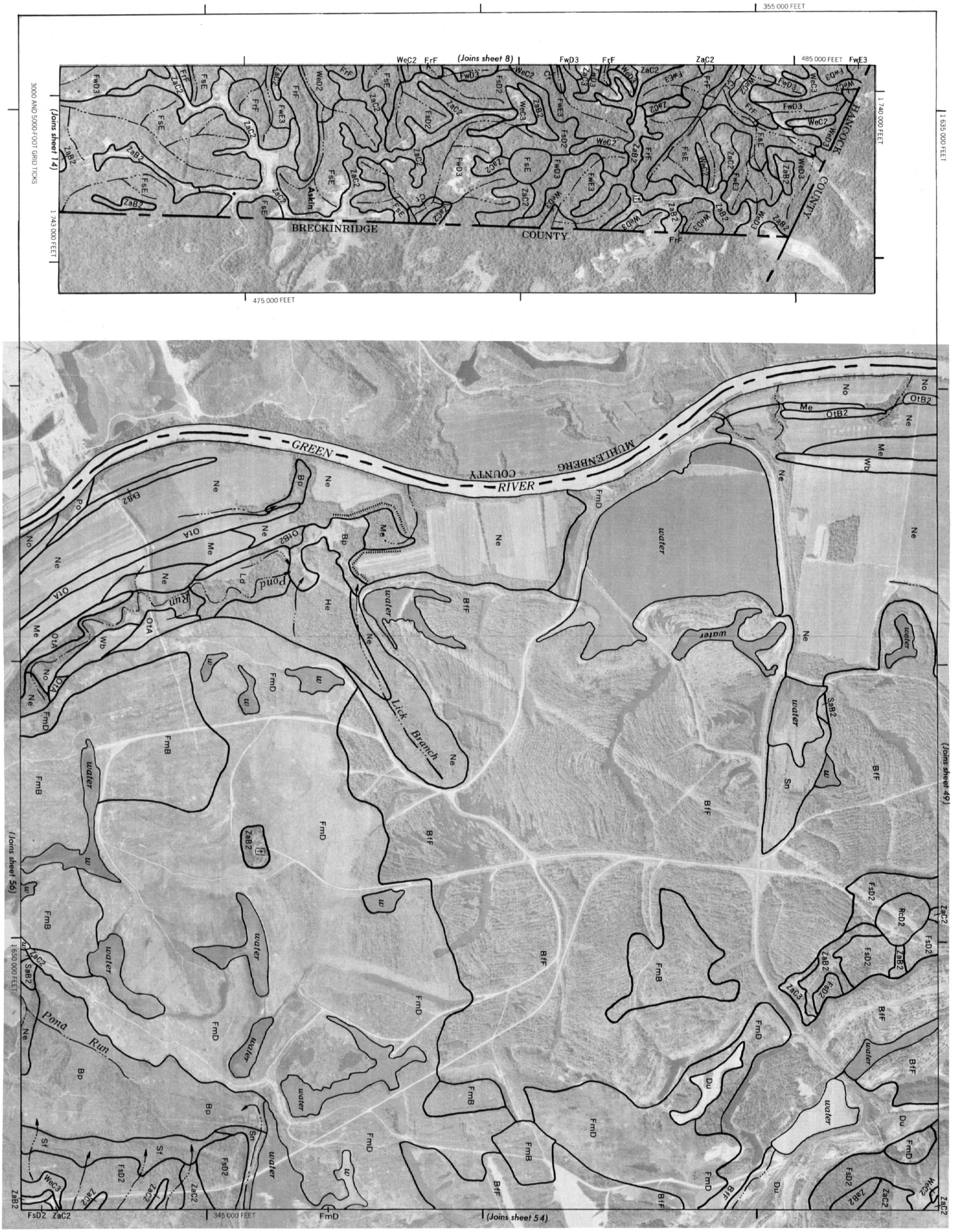
N

OHIO COUNTY, KENTUCKY — SHEET NUMBER 52

This soil survey map was compiled by the U. S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1979 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

OHIO COUNTY, KENTUCKY NO. 52

This soil survey map was compiled by the U. S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1979 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



OHIO COUNTY, KENTUCKY — SHEET NUMBER 53

5000 4000 3000 2000 1000 0 5000 Feet

1 .5 0 1 Kilometer

Scale - 1:20000

N

OHIO COUNTY, KENTUCKY — SHEET NUMBER 54

This soil survey map was compiled by the U. S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1979 aerial photography Coordinate grid ticks and land division corners, if shown, are approximately positioned.

OHIO COUNTY, KENTUCKY NO. 54

This soil survey map was compiled by the U. S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1979 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

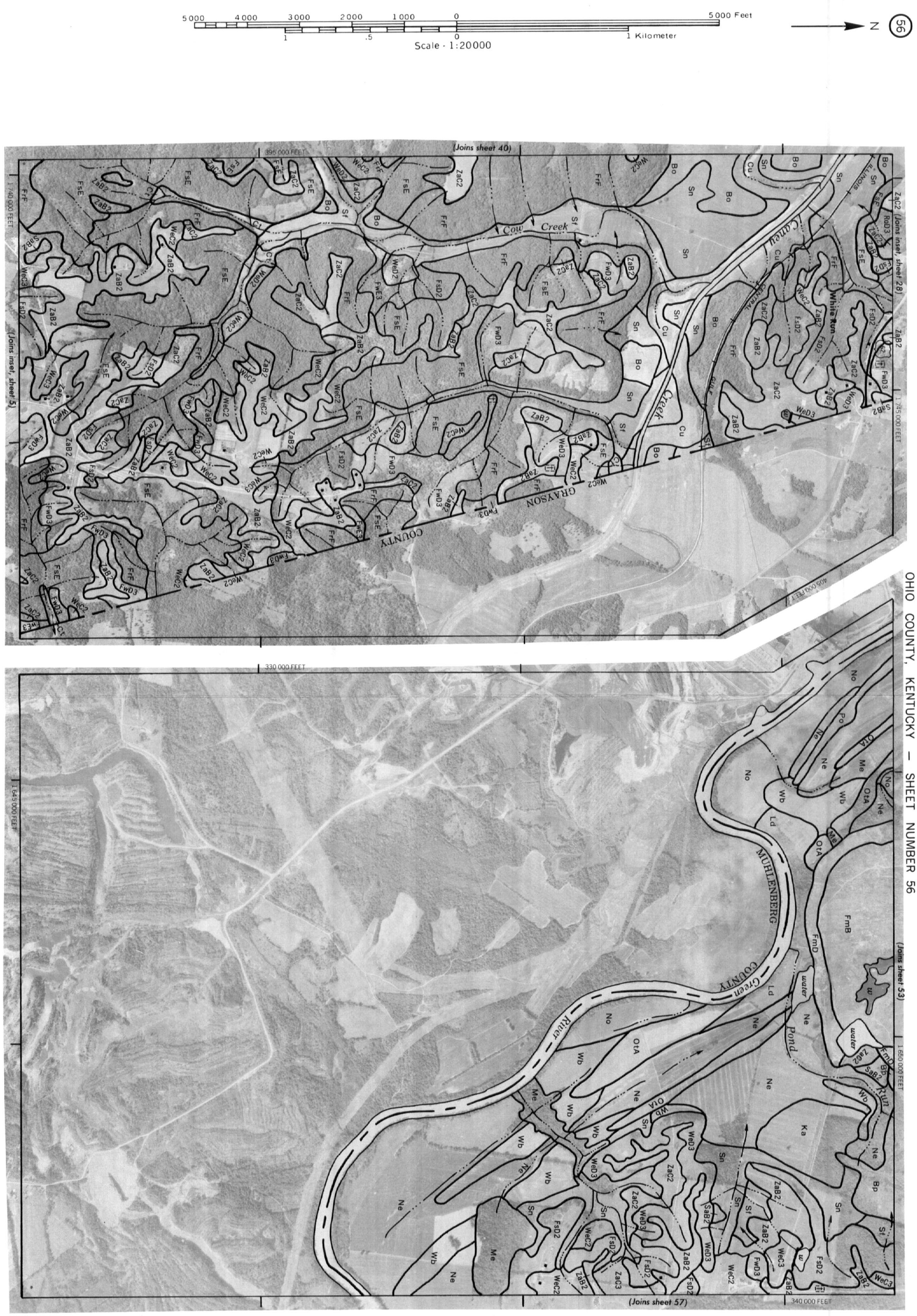
OHIO COUNTY, KENTUCKY — SHEET NUMBER 55

5000 4000 3000 2000 1000 0 5000 Feet

1 .5 0 1 Kilometer

Scale - 1:20000

N



OHIO COUNTY, KENTUCKY — SHEET NUMBER 56

This soil survey map was compiled by the U. S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1979 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

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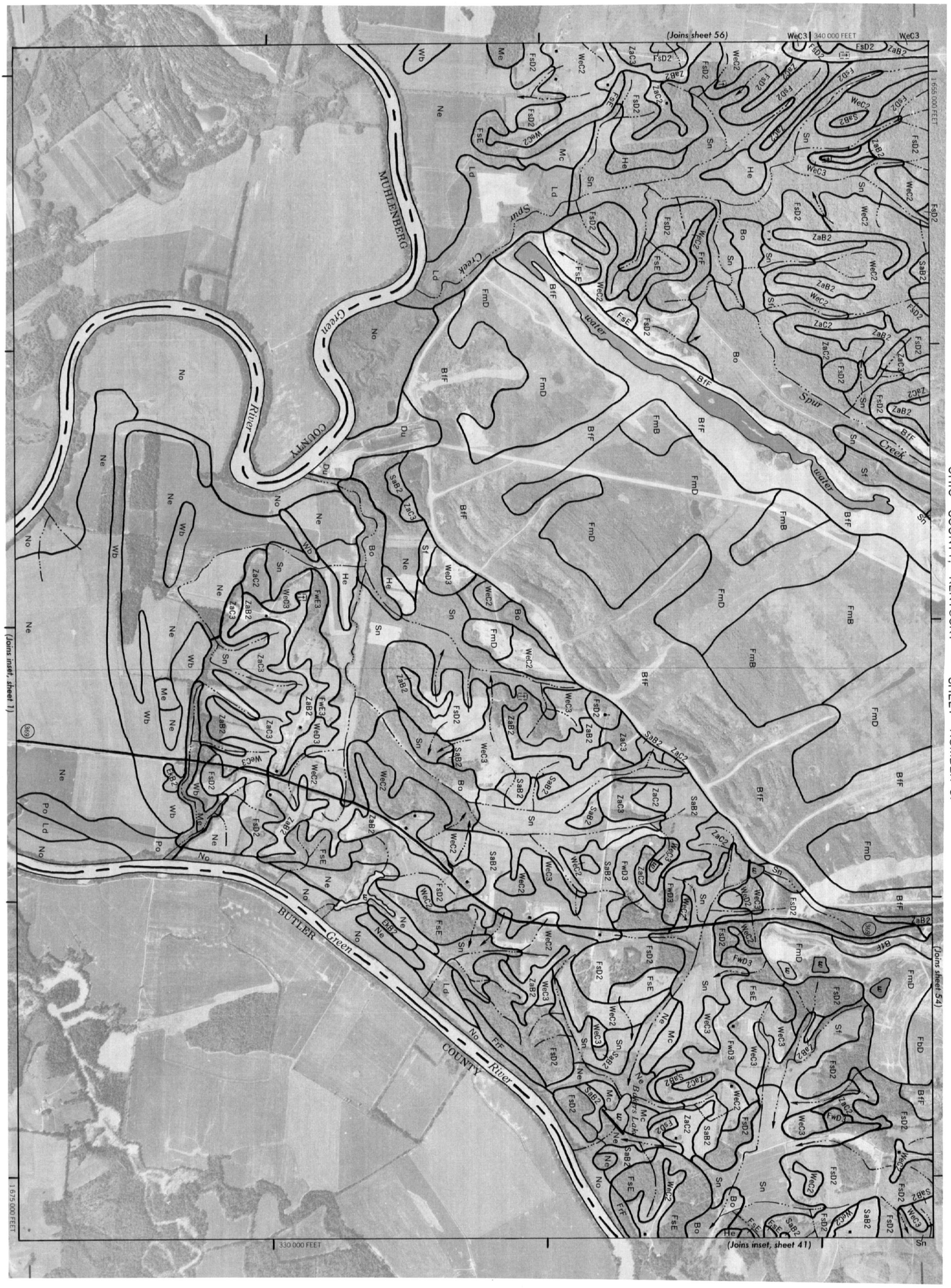

OHIO COUNTY, KENTUCKY — SHEET NUMBER 57

5000 4000 3000 2000 1000 0 5000 Feet

1 .5 0 1 Kilometer

Scale - 1:20000

N